Mariners Weather Log

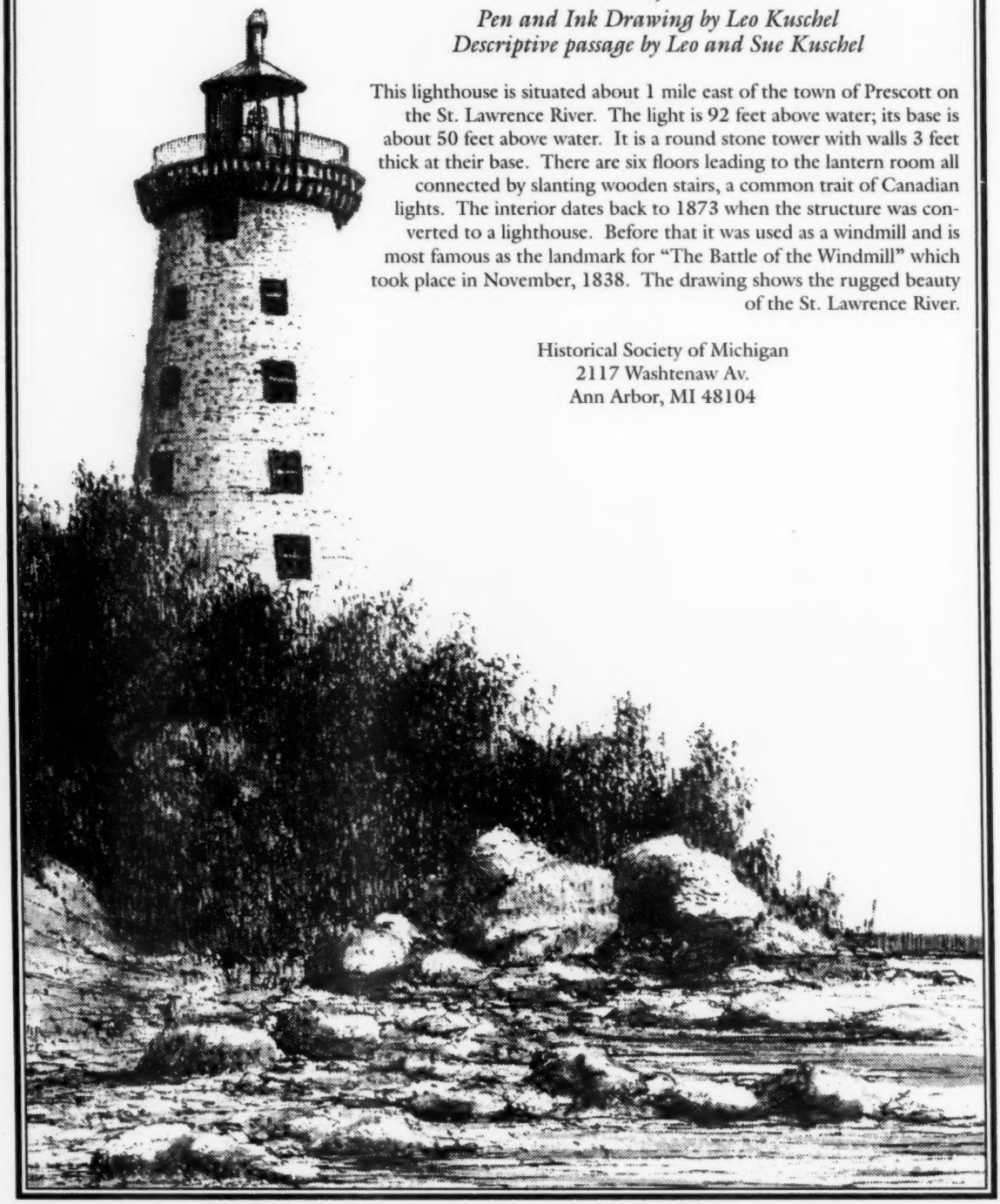
Spring 1993

Sacred Vision

Windmill Point Lighthouse

St. Lawrence River
Prescott, Ontario

Pen and Ink Drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel



This lighthouse is situated about 1 mile east of the town of Prescott on the St. Lawrence River. The light is 92 feet above water; its base is about 50 feet above water. It is a round stone tower with walls 3 feet thick at their base. There are six floors leading to the lantern room all connected by slanting wooden stairs, a common trait of Canadian lights. The interior dates back to 1873 when the structure was converted to a lighthouse. Before that it was used as a windmill and is most famous as the landmark for "The Battle of the Windmill" which took place in November, 1838. The drawing shows the rugged beauty of the St. Lawrence River.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

Mariners Weather Log

Spring 1993

Vol. 37, No. 2

The December Nor'easter in the North Atlantic created problems all along the East Coast of the U.S. Story on page 65.

Kings Point Celebrates its 50th— page 12

Departments

Marine Weather Review

October, November, and December 1992

Cover: *Sacred Vision* by Michael K. Ward indicates the bounty of nature that is found in the Channel Island National Marine Sanctuary. The interpretation of the art is found on page 2 while the sanctuary story is on page 1a.

Back Cover: Michael Halminski's beautiful photograph of the cruise ship ***Fair Sky*** was taken off of Cabo San Lucas, Baja California, Mexico. Story on page 30.

Mariners Weather Log

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Editorial Assistant
Nancy O'Donnell

Columnists
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Computer Specialist
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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1993.

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Editor, Mariners Weather Log
National Oceanographic Data Center
1825 Conn. Av., NW
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Cover Story

Long before Columbus or Erik the Red discovered America its waterways were being routinely navigated by Native Americans— a great diversity of Indian nations speaking more than 500 languages. When the newcomers arrived they were greeted by lighthouses, weather–wise river, lake and harbor guides and other navigational aids. Native Americans such as the Chumash Indians of California had already established a thriving coastal and inland waterway trade as well as their place in American maritime history.

The cover photograph was taken from a poster prepared for the Channel Islands National Marine Sanctuary. The idea was conceived by NOAA's Lt. Commander Stephen Jameson who is part Cherokee and was Sanctuary Manager at the time. His idea was wonderfully translated by Michael K. Ward an artist and noted authority on Chumash Indian history and culture. Ward has had an interest in Chumash and California Indians for most of his life, and in 1984, was adopted by two Chumash councils and the late Chumash Elder, Vincent Tumamait, and his family. Mike presently lectures about Chumash in many schools and institutions, including programs for the Channel Islands National Marine Sanctuary. Mike is a professional illustrator, and his work can be seen in school textbooks, novels, and several periodicals. He has also had much of his fine art prints and posters exhibited in galleries and museums throughout Southern California.

The cover is interpreted as follows. A Chumash '*alchuklash*, 'diviner or priest,' as indicated by his topknot hairstyle with mature golden eagle feather and bone hairpin, makes an offering to the creator. The '*alchuklash* gives a string of olivella disk beads and eagle plume, items of wealth and high status respectively, and thanks the creator for the diversity of life, so important to his people's existence. He is also a pipe doctor, and holds a sacred pipe, or *tipkhopi*, in his left hand. From the smoke emerges spirits of the first people, the *molokiku*. These spirits represent the original ancestors of the living world. The molokiku are led by *slo'w*, the golden eagle, commander of the skies and foundation of the upper world, and *elewu'n*, the swordfish, commander of the seas. He holds tobacco wrapped in cane in his earlobe and wears a falcon skull around his neck as a talisman for spiritual help. A cormorant feather cape keeps him warm during his night voyage in the *tomol*, a plank boat. The *tomol* planks are held together with *tok*, red hemp line, and sealed with tar. As a final hull sealant, a mixture of red ochre and pine pitch is spread over the hull. The bow is inlaid with abalone ornaments that represent *kakunupmawa*, the old man sun. The *tomol* has been described as "a flower on the water." Overhead in the sky, *ashka*, the coyote star, watches over the '*alchuklash* and chases the maidens or Pleiades constellation across the winter sky.

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The Gulf of Mexico— A Breeding Ground for Winter Storms

Professor S. A. Hsu
Louisiana State University

While not called Nor'easters in the Gulf of Mexico, many winter storms originate and strengthen in these accommodating waters causing havoc along the Gulf Coast.

Gulf storms are sometimes described as "a swollen belly of water surrounded by pouring rain." The ocean surface is bulged upward beneath a whirling, forward-moving, low pressure system. High waves, stirred by high winds form atop this bulge. The worst are meteorological *bombs*, which form quickly and exhibit pressure drops of 12 millibars or more in 24 hours in these latitudes. They are accompanied by waves up to 5 meters (15 feet), floods and strong winds. It is helpful to classify this cyclogenesis or storm development on the basis of minimum pressures and related maximum wind speeds.

Pressure variations are significant especially in the tropics where they are normally minor compared to those in higher latitudes. Pressure observations are plentiful thanks to reports from ships and other platforms in the Voluntary Observing Ship program.

Cyclogenesis is defined as a development or strengthening of cyclonic circulation in the atmosphere. In certain coastal regions such as the Louisiana/Texas shelves, cyclogenesis is an important phenomena for shipping and drilling interests as well as coastal residents and businesses.

In a 1949 climatology of Texas-West Gulf cyclones, covering a 40-year period, an average of 9.7 cyclones per year developed across the region with an average length of time of 11 years between peaks. The majority of these storms developed between 25°N. and 30°N., from 90°W. to 99°W. Using 1972-1982 as a control period, an average of 10.4 winter cyclones developed each year over the Gulf of Mexico and in 5.5 of these, central pressures dipped to 1010 millibars or below. From November 1982 through March 1983 a total of 26 surface cyclones affected the Gulf region, and five of these met the criteria for meteorological *bombs*. During these intensification periods the mean subtropical jet stream was about 5° farther south than normal over the Gulf of Mexico. This southward displacement of the mean jet stream, particularly during *El Niño* years, was an important factor in the formation of upper level disturbances. When these upper-level lows move over the surface weather front along the shelf break, the cyclogenesis or storm formation and deepening process, is enhanced. This means there is a good chance for the rapid development or intensification of a coastal storm.

A classic example of cyclogenesis over the Gulf of Mexico and its effect on shelf waters occurred on February 16, 1983. This storm was one of the top five cyclones that occurred over the Gulf during the 1982-83 *El Niño* year. This storm qualified as a meteorological *bomb* when its central pressure fell 12 millibars within a 24-hour period. Its minimum pressure was 996 millibars with a reported maximum wind of 20 meters/second (39 knots). Reports from a platform in

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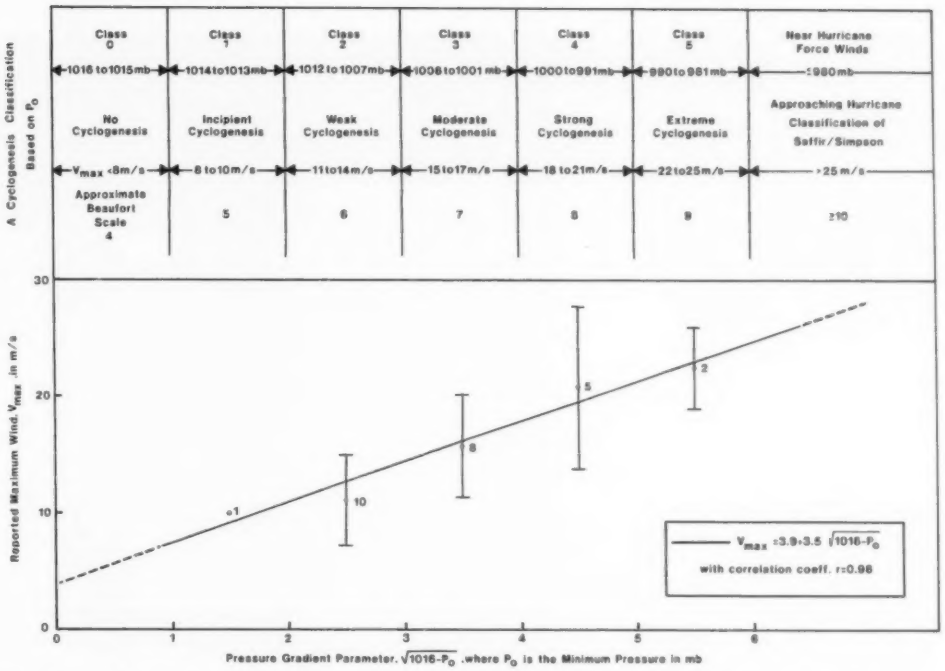
Professor S. A. Hsu of the Coastal Studies Institute at Louisiana State University is working on a 4-year study of cyclogenesis in the Gulf of Mexico. This article was motivated by that of Dolan and Davis, which appeared in the Winter 1992 *Mariners Weather Log* and proposed a classification scheme for Nor'easters affecting the East Coast of the United States.



The cyclogenesis classification (right, top panel) is based on the minimum pressure of winter storms in the Gulf of Mexico. The bottom panel shows the number of storms studied, the relationship between the pressure gradient parameter and the reported maximum winds while the vertical bars are the standard deviations.

the shelf water off Louisiana indicated that the lowest pressure was 1001 millibars with a maximum wind of 15 meters/second (29 knots) and a significant wave height of 4.3 meters (14.1 feet). The time series of the pressure, winds, and waves for this storm is similar to those of a hurricane. A second example of winter cyclogenesis in the Gulf of Mexico and its effect on a Louisiana barrier island occurred on February 27, 1983. This meteorological *bomb* generated seas and tides, which caused erosion and property damage on Grand Isle, Louisiana.

February 1983 also provided a fine example of a Nor'easter that had its origins in the Gulf. A storm which developed near the mouth of the Mississippi River on the 10th moved off Wilmington, North Carolina the following day where the ***John Cabot*** reported 55-kn winds in 20-foot seas. This Nor'easter generated hurricane-force winds by the 13th and devastated the Eastern Seaboard with snowfall of up to 35 inches. New York measured 20 inches, Baltimore had 24 inches, and 26 inches buried Washington, DC. At least 69 deaths were attributed to this storm.

So Winter storms in the Gulf of Mexico are important both to interests in that basin as well as maritime interests along the East Coast. A classification scheme is one method of acknowledging the importance of these systems, and using the relationship of maximum winds to minimum pressures is sound and simple way of achieving this.

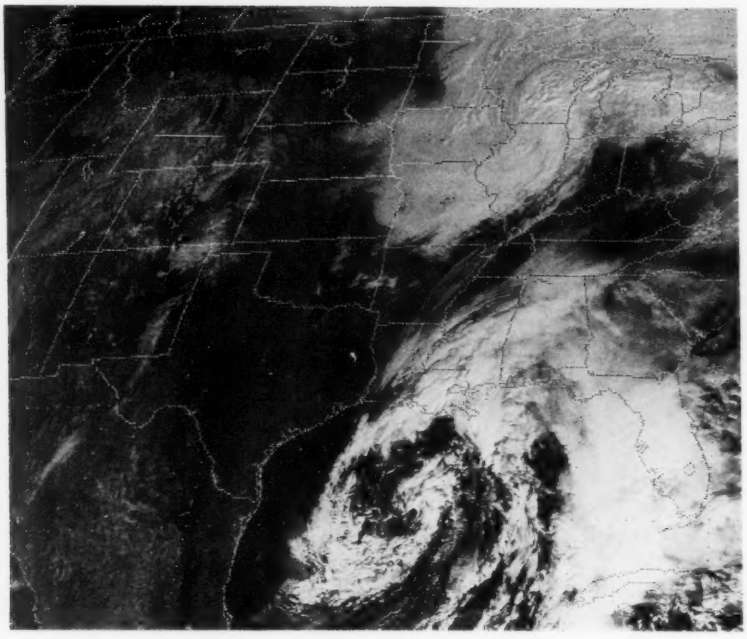
To relate maximum winds (meters/second) to pressure under this classification scheme, the following simple formula is used:

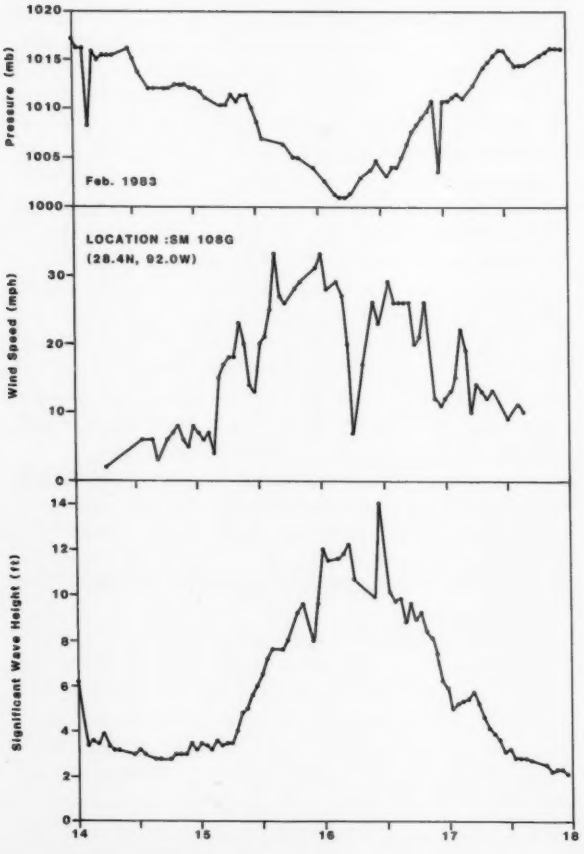
$$V_{max} = 3.9 + 3.5\ (1016 - P_o)^{1/2}$$

In this equation V_{max} is the maximum wind speed (meters/second) while P_0 is the storm's central pressure (millibars).

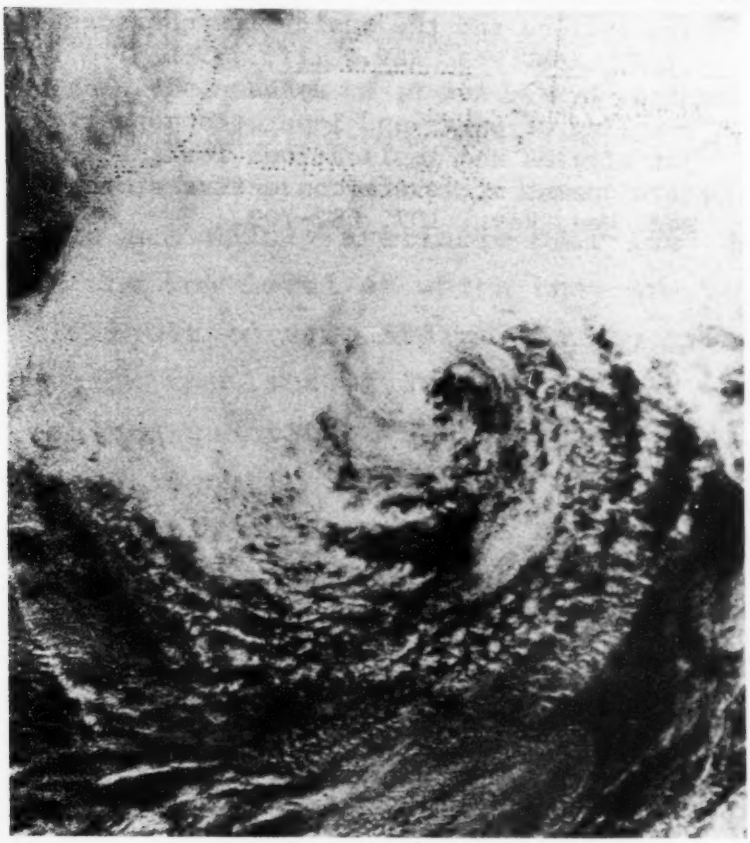
For example, if the storm's central pressure is 991 mb, then the equation works out to 3.9 + 3.5 (25)½ or 21.4 meters/second. Using the classification table this puts the storm in a Class 4 indicating strong cyclogenesis. The suggested classification of Gulf of Mexico winter storms ranges from Class 0 to Class 5 or from no cyclogenesis to extreme cyclogenesis. The corresponding pressure values and approximate wind speeds are indicated in the table above. The major difference between the Dolan/Davis Classification scheme and this one is that theirs is based upon effect (beach erosion) while this one is based upon cause (storm pressure). Despite this difference they are in reasonable agreement. Page 10 contains a semi-technical discussion of the development of the equation and its limitations.

If the lowest pressure in the Blizzard of March '93 is determined to be 972 millibars, as is now estimated, than the Classification equation would work out to 27 meters/second (52 knots), which in the table works out to greater than Class 5 or approaching Hurricane Status– an unusual occurrence in the Gulf of Mexico.





Above is an example of cyclogenesis which took place over the Gulf of Mexico on February 16, 1983. This shot was taken from the GOES satellite. Notice the comma shape whirlpool cloud pattern and also the fact that this system was not linked to other larger scale systems. This was one of the top five cyclones generated over the Gulf during the 1982–83 El Niño period. Not only do surface conditions, such as sea surface temperatures play an important part in the development and intensification of these storms, but the upper atmospheric conditions are critical as well. The time series analysis for this storm (left) was made for atmospheric pressure, wind speed, and significant wave height during the period of cyclogenesis. Note the relationship between pressure and winds. The maximum wind speed does not usually occur at the time of the lowest pressure, but in general the lower the pressure the stronger the wind will be. This particular time series very much resembles a typical tropical cyclone plot as the wind speed would be expected to drop off dramatically in the eye or center of lowest pressure.

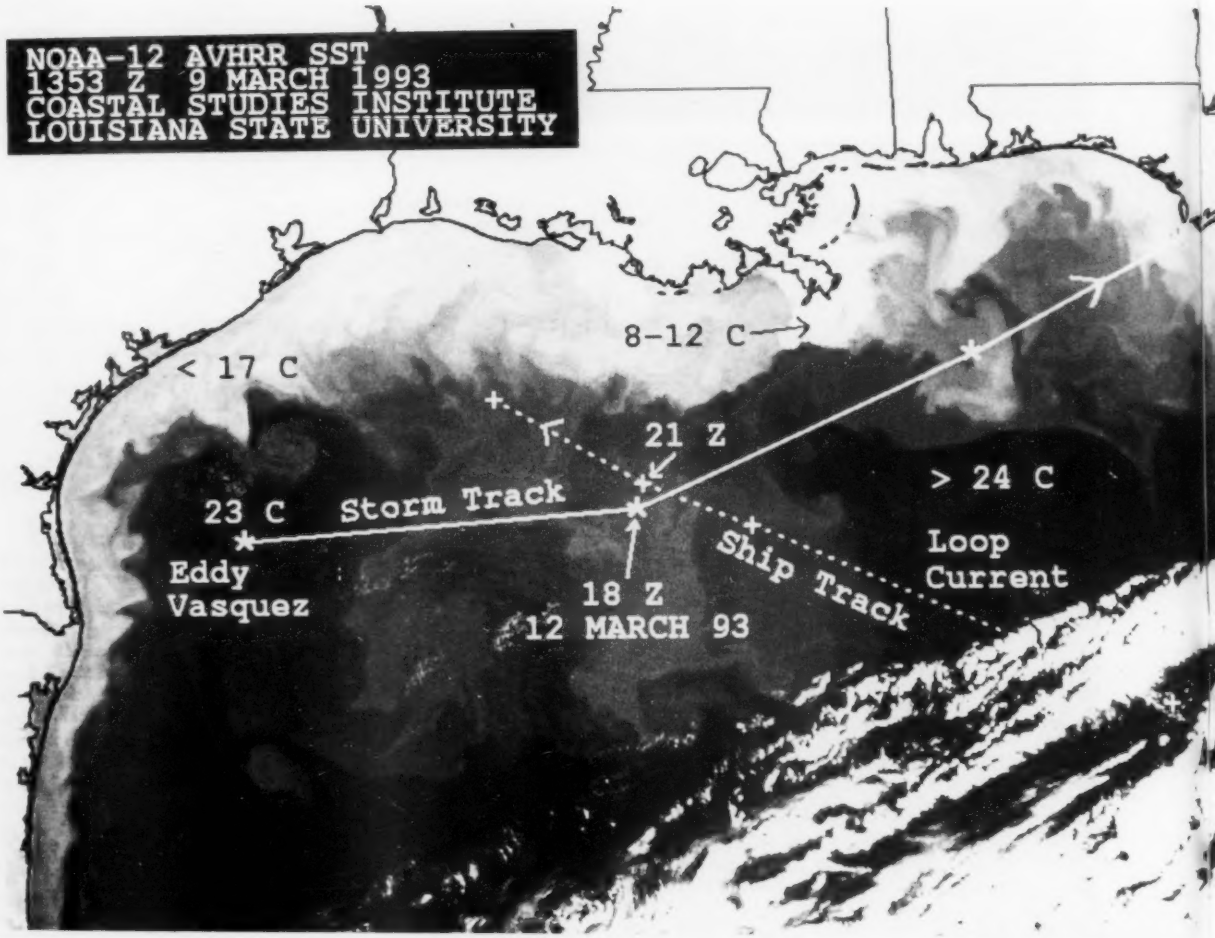


At left is a visible satellite image with 1 kilometer equivalent resolution on February 27, 1983 at 1900 UTC. Notice the nearly circular airflow around this extratropical cyclone. This is important because it means the cyclostrophic equation may be applicable such that forces between the centrifugal and the pressure gradient are in balance. This storm also met the criteria for a meteorological bomb as it intensified very rapidly. The resultant wind and sea conditions in the Gulf of Mexico are not only a threat to shipping and oil platforms but can cause beach erosion and property damage in coastal areas. An example of this effect is seen above in a photograph of beach erosion at Grand Isle, LA. This was provided by the Louisiana Geological Survey, Coastal Geology Section.

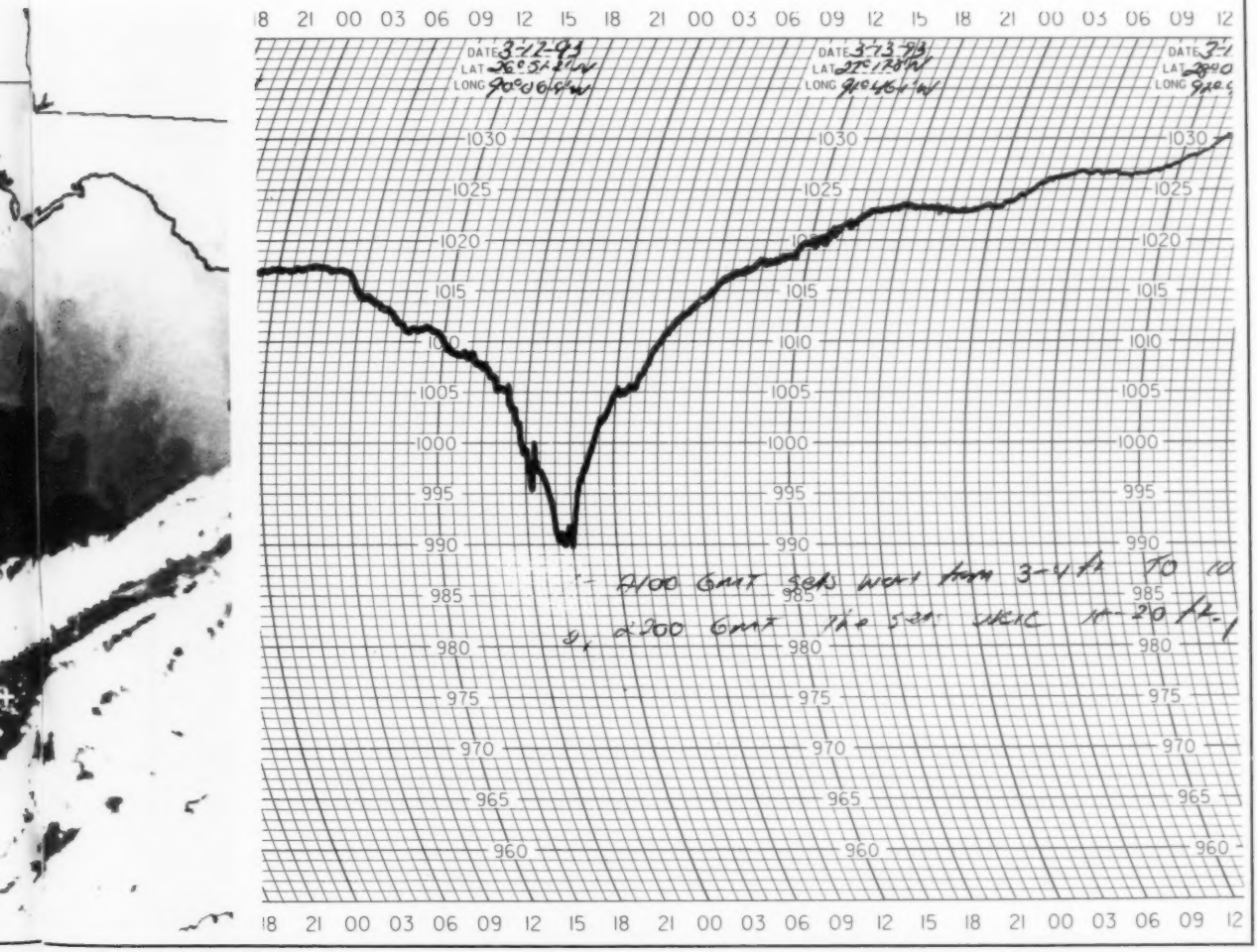
A Preliminary Look at Cyclogenesis in Gulf of Mexico During the March 1993 Blizzard

Dr. Nan D. Walker
Coastal Studies Institute, Louisiana State University

The recent "Storm of the Century" (March 9–12, 1993) provided a classic illustration of extreme cyclogenesis in the Gulf of Mexico. The illustration below shows the sea surface temperature (SST) distributions in the northern Gulf of Mexico on March 9, 1993 at 1353 UTC, derived from the thermal infrared channels of the Advanced Very High Resolution Radiometer (AVHRR) aboard the NOAA-12 satellite. These data are regularly received, processed, and archived at the Earth Scan Lab, Coastal Studies Institute, Louisiana State University. In this image the lighter shades of gray depict cooler waters. The "Blizzard of March 1993" developed extremely rapidly over warm waters in the northern Gulf of Mexico. In this illustration the storm's 6-hourly positions (starting at 1200 UTC on March 12) and its track across the Gulf are overlayed on the clear-sky image obtained a few days earlier. At this time, three large warm-core eddies (shed previously from the Loop Current) were resident in the western Gulf of Mexico and the Loop Current was relatively far north in the eastern Gulf. Initial development of the cyclone began on March 11, 1993 in the northwestern Gulf of Mexico over the



northernmost eddy, Eddy Vasquez, where SST's of 23°C were observed. The storm formed in close proximity to a 7°C SST front trending north–south along the western margin of the Eddy. Continental shelf waters were relatively cold (less than 17°C) due to previous winter heat losses to the atmosphere. The approximate center of storm formation over Eddy Vasquez is marked with an asterisk. By March 12 at 1800 UTC, the storm had moved eastward into the central Gulf of Mexico where its track crossed that of the MV ***Columbia Bay*** headed northwestward toward the Texas coast. The approximate 1200 UTC positions of the ***Columbia Bay*** are depicted from the 11th to the 14th of March. The ship recorded a minimum pressure of 990 mb at 2100 UTC on the 12th suggesting that the storm deepened from 1000 millibars to 990 millibars between 1200 UTC and 2100 UTC as it traversed the Gulf. Thus, its rate of intensification exceeded that of a meteorological "bomb." The storm encountered a strong baroclinic zone again south of the Mississippi River delta where an intense SST gradient of 14°C (8°C to 22°C) over about 20 kilometers (11 nautical miles) was observed. By 1200 UTC on the 13th, the central pressure had dropped an additional 18 millibars to 972 millibars. The SST field in the northern Gulf of Mexico could have contributed significantly to both the initial development and to the explosive intensification of this storm through differential temperature and thickness advection mechanisms. Cyclogenesis is a common occurrence off the East Coast of the United States where frontal waves encounter strong SST gradients associated with the Gulf Stream.



Technical Discussion of Development of Classification Scheme

Since the airflow around the center of these winter storms in the Gulf is nearly circular, as a first approximation the cyclostrophic equation may be applicable such that the forces between the centrifugal force and the pressure gradient are in balance:

(1) $V^2_{max}/\gamma = 1/\rho\ \partial P/\partial\gamma = 1/\rho\ (P_{ambient} - P_0)/(\gamma - 0)$

or

(2) $V^2_{max} = 1/\rho\ (P_{ambient} - P_0)$

and for statistical analysis, equation 2 may be written as

(3) $V_{max} = A + B\ (1016 - P_0)^{1/2}$

In the equations above:

V_{max}	maximum wind speed
γ	radius of the cyclone
ρ	air density
$P_{ambient}$	ambient pressure, which equals 1016 millibars for the annual climatological average over the northwestern Gulf of Mexico.
P_0	minimum pressure of the storm
A and B	constants to be determined from analysis below

On the basis of 26 winter cyclones studied it was verified that:

(4) $V_{max} = 3.9 + 3.5\ (1016 - P_0)^{1/2}$

V_{max}	is in meters/second and
P_0	is in millibars

The correlation of equation 4 is 0.98 and recommended for practical use such as the cyclogenesis classification. This storm ranking scheme however has two constraints.

1) When $P_0 \geq 1015$ mb no cyclogenesis was observed and

2) When $P_0 \leq 980$ mb, the minimum (or central) pressure approaches the hurricane classification scheme of Saffir/Simpson.

With the above conditions along with the interval analysis suggested by Panofsky and Brier and the winter storm classification suggested by Dolan and Davis, five classes for the winter cyclogenesis are proposed. In fact for easy interpretation we use the numerical interval of $(1016 - P_0)^{1/2}$ which ranges from 1 to 6 with 5 classes in between.

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50th ANNIVERSARY 1943-1993

U.S. Merchant Marine Academy Kings Point, New York

"I must go down to the seas again, to the lonely sea and the sky,
And all I ask is a tall ship and a star to steer her by,
And the wheel's kick and the wind's song and the white sail's shaking,
And a grey mist on the sea's face and a gray dawn breaking.

I must go down to the seas again, for the call of the running tide
Is a wild call and a clear call that may not be denied;
And all I ask is a windy day with the white clouds flying,
And the flung spray and the blown spume, and the sea-gulls crying."

–John Masefield

Nancy O'Donnell

Captain James Bise, Jr. and his crew aboard the ***ITB Baltimore*** were battling November Hurricane Kate some 200 miles north of St. Croix, VI when the first of several garbled messages reporting a vessel in distress came through. Responding to the call, Captain Bise found a 42-foot yacht and gingerly maneuvered his 47,000-ton tanker, which was loaded with jet fuel, gasoline and heating oil, around the craft to prevent it from being crushed– a difficult feat in ordinary seas. Bise next responded to the urgent beep of an EPIRB and found a life raft from the 65-foot yacht ***Sunquest,*** and was able to bring this crew aboard in perilous seas– a total of 10 survivors from the two yachts. For his efforts Captain Bise was honored with the 19th American Merchant Marine Award for his "outstanding feat of seamanship exemplifying the highest standards of professional competence under severe, adverse weather conditions." Most gratifying to Bise was being presented the Seamanship Trophy by his Alma Mater–The U.S. Merchant Marine Academy at Kings Point.

Outstanding tests of seamanship are not uncommon to Kings Pointers. Remaining true to its motto, *Acta non Verba,* **Deeds not Words**, has enabled the Academy to become one of the world's foremost institutions in the field of maritime education only 50 years after its inception.

Some of the Nation's best and brightest men and women come to the shores of Long Island Sound to study for careers as licensed officers on U.S. flag merchant vessels or as commissioned officers in the service of their country. They travel from all of the 50 states and the District of Columbia, from the common-

At left is Wiley Hall, the administration building at Kings Point, which was formerly the hub of the Walter P. Chrysler estate. It overlooks Little Creek Bay and the East River. When Academy founders searched for a motto that would emphasize commitment to excellence they chose the Latin words "Acta Non Verba" which appears on this gatehouse on the Academy grounds.

wealths of Puerto Rico and American Samoa, the Virgin Islands, Guam, Mariana and Marshall Islands.

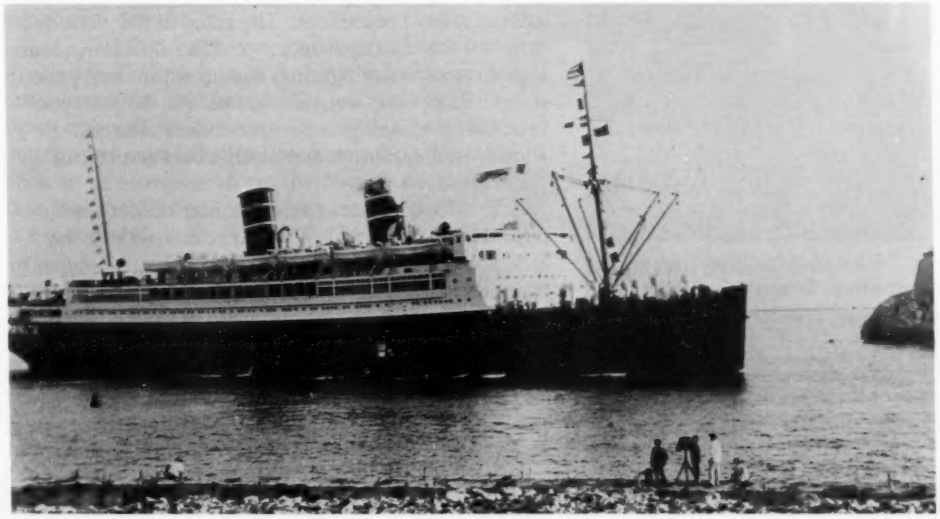
The Merchant Marine has always played an important part in American history. Many early settlers were mariners, and shipbuilding became one of the first industries when the colonists recognized their livelihood depended on their ability to trade with Europe and South America. By the mid-eighteenth century, there were so many shipyards along the Atlantic that angry British shipbuilders in London complained: "New trade, by the tender of extraordinary inducements, has drawn over so many working shipwrights that there are not enough left here to carry on the work." An official of the East India Company cautioned that "there is nothing more prejudicial, or in prospect more dangerous, to any mother-kingdom than an increase in shipping in her colonies."

Still the number of "dangerous" colonist vessels increased and after the war of independence, the merchant mariners and their ships became the original American navy.

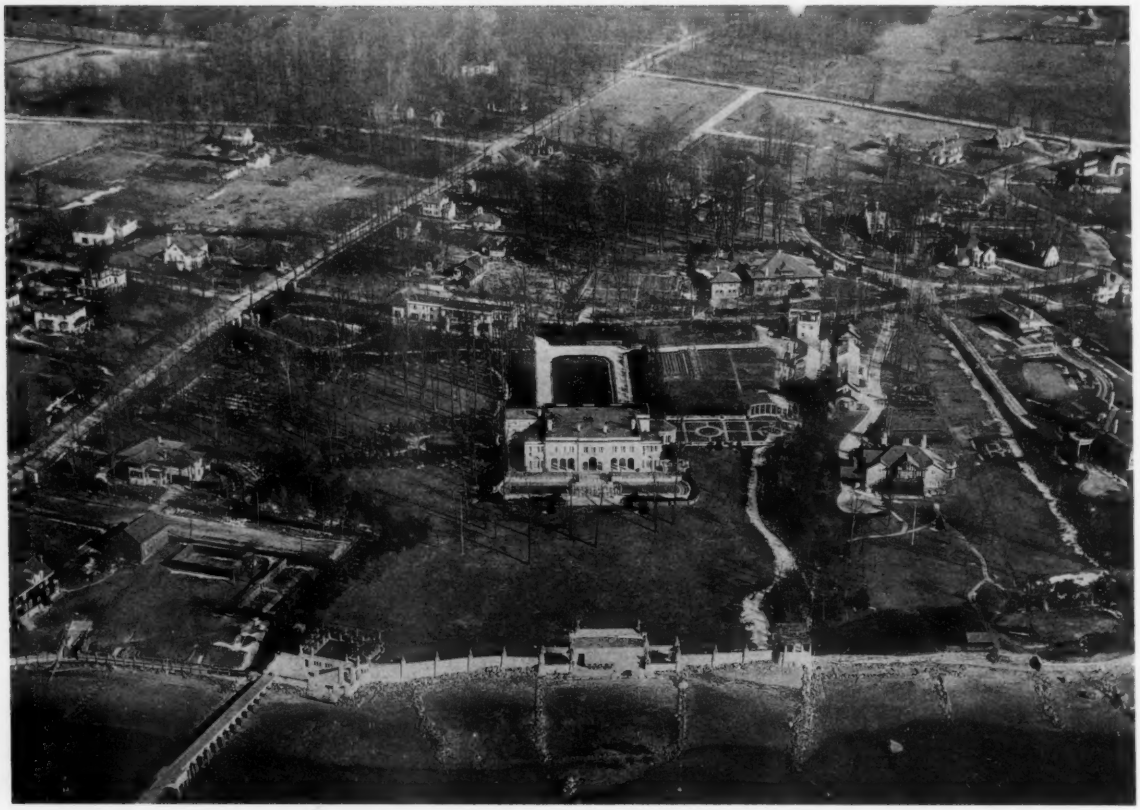
The first United States Congress acted to support the merchant marine through the nations' tax laws. In addition to supporting commerce, this act also pointed to national defense as an important reason for having a merchant fleet.

During most of the 19th century, regulation of American shipping was lax. But after a century of *laissez faire*, President Ulysses S. Grant initiated various programs to train citizens for service in the merchant marines. Between 1874 and 1936, Federal legislation supported maritime training through schoolships and internships at sea. Still for the most part, men were hired with or without training to keep the fleets moving.

Unfortunately, as is true of most maritime legislation worldwide, it took a disaster to get a governing body to act. The International Ice Patrol didn't exist until the ***Titanic*** went under, and Plimsoll didn't make his mark until several vessels sank off England in the late 1870s after being overloaded by greedy shipowners. In the case of enforcing safety regulations, maritime and construction standards, and the establishment of a trained corps of merchant mariners, it took a disastrous fire aboard the ***Morro Castle*** to spur the U.S. Congress to action. A tragic series of misjudgments and near criminal negligence led to 124 deaths aboard the ***Morro Castle***. On September 7, 1934, speeding ahead of a storm of near hurricane force, the vessel ran into squalls and gale-force winds just past the Delaware Capes. Chief Officer William F. Waims could barely see the lighthouse at Cape May. Within hours of its home port, the ship's captain suddenly died of a heart attack and an officer found the



*The **Morro Castle** is seen here entering Havana, Cuba on one of its routine runs. On its last voyage the Captain died suddenly before the vessel reached port. There was speculation that he was poisoned by a disgruntled radio officer and there was even conjecture that the disastrous fire was the result of arson. Photo from the Frank Braynard Collection.*



writing room consumed by flames. Within minutes the midsection of the ***Morro Castle*** was an inferno. The overconfident captain had held only two drills because his vessel was equipped with the latest in fire detection. The series of errors that followed caused scores of deaths– fire doors that would contain the flames were left open, large lifeboats burned or departed with only a handful of passengers and crew, a SOS was sent too late because it would cost the company money. Early the next morning the vessel once considered one of the safest was powerless and burning at anchor off Sea Girt, N.J.

Some passengers lucky enough to get life preservers died because they never learned how to use them. In the *Morro Castle* by Hal Burton, a crew member gives this account: "A lot of them [passengers] held their hands at their sides. When they hit the water, the cork blocks slammed under their chins and knocked them out so they drowned, or fractured their necks so they died instantly. Then there were others who held their hands over their heads. They just simply slipped through...many of them drowned right alongside the boat."

From the stern the terrified passengers leapt into the water, while in the bow crew members escaped in lifeboats. Ninety-four of the 318 passengers died; 30 of the 231 crew members perished.

With the news of the casualties, Congress decided that direct Federal involvement in standardized training was urgently needed particularly in the area of safety procedures. The reforms that followed targeted the use of sprinklers and fire doors, the training of crews in fire fighting, and abandon-ship procedures. Radio laws were also reformed. Most important, laws pertaining to personnel were changed– shorter hours, more money, and closer scrutiny of those hired.

The landmark Merchant Marine Act was passed in 1936. Title I of the Act declared that the U.S. policy was to foster the development and encourage the maintenance of a merchant marine for both shipping and as a military auxiliary in time of war or national emergency." With World War II on the horizon, this fortuitous Act stressed that the new merchant marine have the "best equipped, safest and most suitable types of vessel, constructed in the United States...manned with trained and efficient citizen personnel."

A Maritime Commission, headed by Joseph P. Kennedy, was charged with putting the Act into operation. The commission soon discovered that while the U.S. had a fleet of merchant vessels, a large number had been built before World War I. Tankers which could be used by the Navy as supply carriers were low speed vessels that would be useless in times of national emergency. Within a few years, a necessary shipbuilding boom created a greater need for skilled mariners to sail the vessels.

The morale of many Merchant seaman was at its lowest before the ***Morro Castle*** disaster. Shipowners had paid scant attention to the needs of the men who ran their ships. Crowded, poorly ventilated, unsanitary quarters, bad food, and long hours contributed to the problem. Some crew members on the ***Morro Castle*** were paid only $10 a week, low wages even for the Depression.

One young worker, Colin Houston, described how miserable their life on board: "The food was abominable. I can remember one seaman carrying a plate of rotten fried eggs up to the bridge deck and shoving the plate in Captain Wilmott's face."

The reforms in the basic living conditions reemphasized the need for better training. There had been several state nautical schools, but it was necessary for a more comprehensive educational system. Although seaman were required to have certificates that proved they had 3 years of service on ships, no photographs were affixed and often these certificates were sold by sailors to any man, even those who spoke no English. The new, revitalized Merchant Marine couldn't afford to recruit men from waterfront flophouses.

Kings Point became a symbol of this rejuvenated service. When World War II broke out, the Academy was called upon to truly become "the fourth arm" of national defense.

The first temporary training facilities were constructed in 1942 and the early founders were nothing if not inventive as they foraged for materials in a strapped wartime economy. One account details a determined expedition to Brooklyn's Bush Terminal for a set of generators from the ***Normandie***. In less than 2 years, the commanding waterfront estate of the late automobile baron Walter P. Chrysler was converted into barracks, offices, and classrooms. A curriculum was designed, and students were trained and graduated as third mates and third assistants engineers. Within a 2-year period, enrollment rose to 2,700 while the urgency of the war effort reduced the planned course of study from 4-years to 24-months or less.

Art Cooperman, head for 25 years of NOAA's Marine Branch and director of the *Mariners Weather Log* from its inception in 1957, vividly remembers his days as a Kings Pointer. As a cadet in early 1943, he trained for 3 months at the Academy before he was assigned a 6-month tour of sea duty. Another 9 months at the Academy would follow. His first sea assignment was especially memorable. On June 1, 1943 he and three classmates were aboard the empty T-2 tanker ***Pueblo*** out of Hampton Roads. Cooperman had just finished his 8 p.m. to midnight watch and was getting ready for bed when he felt the ship "jump about 2 feet out of the water." His initial reaction was that they had hit something. The alarm sounded and as Cooperman rushed to his battle station, he saw the entire sky ablaze. The vessel ahead, the SS ***John Morgan***, outbound on its maiden voyage, had collided with the T-2 tanker SS ***Montana***. On the ***John Morgan*** only three Navy people survived while all 41 merchant seamen were killed– including two Kings Point midship-

On page 14 is an aerial view of the 82-acre Walter P. Chrysler estate, before it was converted into the barracks, offices and classrooms that make up today's U.S. Merchant Marine Academy. Congress acquired the land and buildings in early 1942 and 15 months later the Academy was virtually completed. President Franklin Delano Roosevelt dedicated the Academy on September 30, 1943. Academy students (above) are truly a celebration of diversity. Nearly 20 years ago, it became the first federal service school to enroll females, and beginning in 1980, Kings Point opened its doors to several Russian cadets as part of it program to train foreign students.

Academy Profile

Frank O. Braynard

Whatever gives Frank Braynard his energy ought to be bottled and sold. To read from the list of his past and continuing achievements is to see how a consuming passion for all things maritime blended with a sharp intellect could create a body of work that will benefit generations. Author and illustrator of 33 books–once journalist for the *New York Herald Tribune*–inveterate traveler and lecturer on cruise liners–Curator of the American Merchant Marine Museum at Kings Point–naval historian–an early founder of the South Street Seaport Museum in New York–organizer of Operation Sail, the U.S. Bicentennial celebration of Tall Ships are only few of his accomplishments. And then there are his most current projects: several books, a new maritime museum in New Orleans, and yet another visit from the Tall Ships.

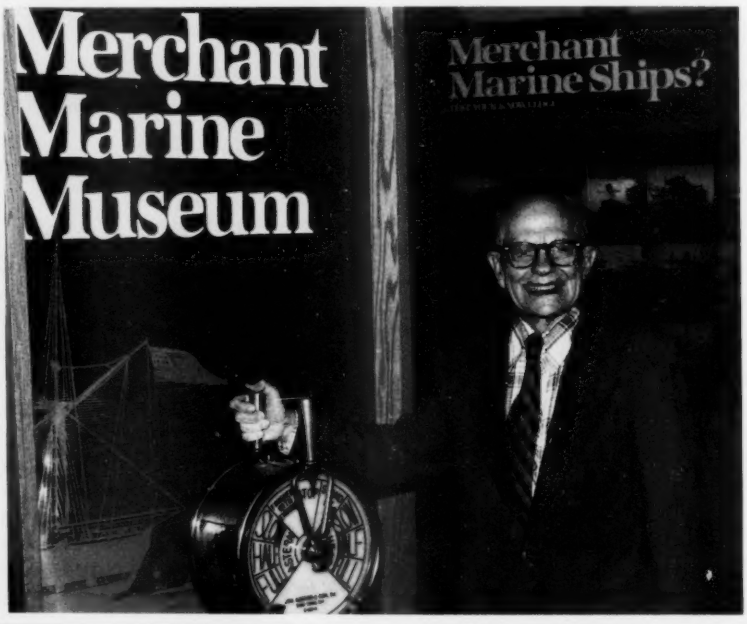
Despite this enormously rich and demanding professional life, Braynard also found time to marry and raise a family.

"My wife Doris teaches grammar school. She's a bigwig with the American Association of University Women. My children do what they want to with absolutely no interference from us. My daughter, Noelle, is a ballerina. She's been married for 10 years and to our delight we are now grandparents. Isabelle is 3 years old, and if I may say so, she's extremely bright." My son David is not married. Every time he comes up to visit he has a different girlfriend. He plays the tuba for the American Ballet Co." Braynard has high praise for his son's talent, "He recently sight read a 5 hour monster performance of a Wagner opera."

Braynard's love affair with the sea and its ships started more than 70 years ago. At the age of seven, he carefully sketched his favorite ocean liner, the ***Leviathan***. While he spelled its name correctly, he signed his own Frank Braynrad. From then on he never wavered. Once when given an assignment to write about fascism, he wrote about shipping under fascist rule. He received an M.A. in history at Columbia University, but left academia because "I knew nothing but ships."

First, he worked at the American Merchant Marine Institute, then moved into public relations for the Moran Towing and Transportation Company. His favorite was being a marine reporter and assistant marine editor at the *Herald Tribune*.

"I've always had wonderful jobs. I'm just doing things I like doing. I see the poor clods on the Long Island Expressway and..." He leaves the sentence unfinished, but he obviously pities the millions of anonymous commuters who travel past him everyday on their way to jobs they hate. Two days a week Braynard travels from his home in Sea Cliff, Long Island to the Merchant Marine Museum at Kings Point.



"The building is a treasure, stained glass. There's a lovely view of the Throgs Neck Bridge. The building was built by William Barstow, a partner of Thomas Edison."

The museum's 10 exhibit rooms contains a wide cross section of marine artifacts– an 18-ft model of the famous passenger ship, ***SS Washington***, a collection of rare navigational instruments, hundreds of coffee cups from shipping lines around the world.

"We have 50 years of gifts given to the merchant marine– artifacts, models, the cream of the crop."

Braynard never stops adding to the collection. "At 2:30 today I'm going to a lady's house. She called me. She's giving the museum 150 small metal model ships. We constantly get gifts."

Braynard is also planning another maritime exhibition similar to Operation Sail '76, the parade of tall ships in New York Harbor. He was creator and director of the event that many Americans felt captured the spirit of the nation's bicentennial celebration. Today he works with a friend, the Rev. William Wendler of Quog, Long Island, to organize Americas' Sail 1994, a gathering of all of the 12 Tall ships in North and South America. The tall ships will race from Norfolk to New London, but there won't be any prizes. "They'll be doing it for the fun of it." While *Newsday* has contributed $5,000, volunteers are doing all of the work Braynard said. "They will finish the race just around Montauk Point, Long Island. They will sail together, in company as they say, to some point near the Merchant Marine Academy and anchor for the night."

Braynard simultaneously works on several book projects. One book deals with the "great, but sadly neglected Italian ships." He describes the ***Rex*** and ***Conte di Savoia*** as "unbelievably elegant."

"The ***Rex*** broke the speed record on the Atlantic. It was the only Italian vessel to ever win the Blue Ribbon of the Atlantic. This was in 1932. I believe its average speed was 25 knots. The ***Conte di Savoia*** was the first ship with a gyro stabilizer. They said it would prevent anyone from getting seasick. Of course, it didn't work. Mussolini insisted it sail on time, and it wasn't ready. An accident occurred and it put a 2–foot hole below the water line. Such a tragedy. They were both destroyed by England and America during the war. It just shows how horrible and stupid war is."

Dover Press is interested in another of his ideas– a book of posters of 500 large ocean going liners.

"I've collected them since I was a child. Some were given to me, some I got from the ship lines, some in secondhand stores. When the stores buy offices downtown, they buy everything, even the painting on the walls. I found an original painting of the ***Servia*** from the Cunard Line. It was painted by a Danish painter, Antonio Jacobsen. I bought it for $25, now it's worth–I hate to say it–$90,000."

Another project is one he's "very excited" about.

"Dover has a tremendous collection of *Illustrated London News, Harper's Weekly* and *Leslie's Weekly* which was like *Time* 100 years ago. They didn't have photographers then. Classic artists, hundreds from all over the world, drew these absolutely beautiful illustrations. If there was an earthquake, an artist would draw it on the spot. Dover has given me the job to cull out every ship picture. They gave me a job of doing three books about ships, seaports. All the seaport pictures would make a wonderful book. Just add the captions, the introduction...you'd have a wonderful book."

It's hard to think in terms of favorites, but the ***Leviathan*** was by far the one vessel that captured Braynard's imagination and became the catalyst for his life's work. During the years of the great ocean liners, the German built vessel carried millionaires and film stars and captured the drama and glamour of the Roaring Twenties. Brayard's one million word 6–volume work on the ***Leviathan*** contains 1,500 illustrations. In the process of writing it, he interviewed 4,000 people.

Thirty years after the vessel was scrapped, it still fascinated him.

"I found the nameboard of the ***Leviathan*** hanging in a bar in Hoboken in the 1960s. I was working for Moran Towing then. My job in public relations was to show that Moran was the premier tugging company in the world. I would give away pictures of tugs, give rescue pictures to reporters, writers. I'd go out for a day on the tug. Take reporters. One day we stopped in Hoboken. I always thought Hoboken would be good place to find things because a lot of German liners berthed there."

He went into Max Schulman's Hofsbrau Haus and there was ***Leviathan***'s nameboard.

"The man there wouldn't sell it under any circumstances. The 4th or 5th time I went it was no longer Max Schulman's, but Nick's Bar and Grill. This man wasn't in the least bit interested in it. I paid $35 for it. It was 21 feet long."

His next big challenge was how to get it home to Sea Cliff.

"I'd have to pay to have it transported. I called a friend and talked to one of his assistant. The man said, 'My wife's father worked on the ***Leviathan***. I'll do it for free.'"

Braynard eventually donated the nameboard to the Smithsonian, but he's not very happy about where it's been exhibited.

"I've always felt that planes were a passing fancy, "Braynard said. He is only half joking. "The Smithsonian has a whole building for them. It's an outrage. They have only six rooms in the basement of the American History museum for <u>all</u> ships. And they have a new wing for rockets and airplanes. It's a disgrace."

Perhaps Braynard will next create a national movement to build an entire maritime museum on the Mall, but his high energy will have carried him and his wife on yet another ocean cruise as we go to press.

"We'll be sailing on the ***Polaris***, a Special Expedition, from Antigua to Lisbon. We'll stop in the Azores. I'll lecture on great liners, tall ships and Operation Sail. My wife will lecture on the opera."

*The USS **Contender** was recently transferred to the Academy by the U.S. Navy's Military Sealift Command during ceremonies at Pearl Harbor, HI in October 1992. The 224-foot vessel will be used as a training ship for midshipmen at the Academy. Formerly a submarine surveillance vessel, the ship will be commissioned soon. Students will join this "floating laboratory" where they can learn shiphandling, seamanship, firefighting, naval operations, navigation, and weather. The vessel is capable of cruising at 11 knots with a range of 3,000 nautical miles.*

men. This tough initiation at sea stayed with Cooperman and his fellow cadets through the rest of their training and through the remainder of the war as they plied the dangerous waters of the North Atlantic in convoys.

Many Academy graduates participated in convoys that resupplied American troops and served at sea in combat zones around the world. Out of the 30,000 merchant seamen who died in the war, among them were more than 200 Kings Point midshipmen and graduates and cadets.

By the wars' end approximately 6,634 officers had been graduated. In peacetime the academy was converted to a 4-year college level program operated by the Maritime Administration of the U.S. Department of Transportation.

President Franklin D. Roosevelt acknowledged the special role Kings Point would have in the future when the academy was dedicated on September 30, 1943, "The Academy serves the Merchant Marine as West Point serves the Army and Annapolis serves the Navy."

Many innovative changes have taken place on the 82-acre waterside campus since dedication day. In 1974, the Academy became the first federal service school to enroll female students. One student, Nancy L. Wagner, became the first female harbor pilot in the United States. In 1980, when Congress wrote new legislation that allowed up to 30 foreign students each year, Kings Point opened its doors to several Russian students. Many Kings Point alumni have gone on to distinguished careers in business, law, the military, and sciences—the late Elliot M. See, Jr '49, Gemini Space program astronaut; Edward S. Dennis, Jr. '67, former U.S. attorney; Lane Kirkland '42, National President of AFL-CIO; former White House Fellow Meredith Neizer '78; Radm Carl Seiberlich, USN (ret) '43, Commander, Apollo 11 and 12 astronaut recovery group.

Much has changed in the basic training that merchant mariners receive. "Through the hawse pipes" was once the way to reach officer status. A sailor had to learn through a course of self-study and the "hard school of the sea" was the classroom. Today, students at the Academy use high-tech equipment like the ship's bridge simulator which generates a color-video display that duplicates what a pilot or bridge officer would see from the bridge of a moving vessel. The simulator is used in a Bridge Watchstanding course to help senior midshipmen and others in post-graduate studies to build effective decision mak-

ing skills in ship traffic and voyage planning. Run by a central computer, it recreates ship dynamics and environmental factors. The computer feeds information to an image-generation and display system that simulates sun positions, fog conditions, ship position and heading, and up to six other ships moving in the area. Surrounded by a 240-degree cylindrical display, the simulator stands 12-feet high and 120-feet long.

Meteorological training is provided in the classroom and at sea. Greg Smith, a licensed Deck Officer with a degree in Meteorology, teaches a basic course that includes observation techniques and the basic principles of forecasting. At sea on commercial vessels, the classroom instruction is put into practice.

Kings Point provides a demanding program, geared to management and technical skills for leadership positions in the maritime industry. Students are nominated by a Member of Congress and, if accepted, receive a topnotch tuition-free education.

Plebes first come to the Academy for "Indoc," a 2-week period where they can get an idea of the rigorous program ahead. Up at 6:10 a.m., students study throughout the day until 9 p.m. Lights Out. Later, called midshipmen, a term used for both men and women, they can choose from three basic curricula: Marine Transportation (Nautical Science and Maritime Administration), Marine Engineering, or Marine Engineering Systems. Especially important is the Ship's Officer Program and Dual License Program which prepares students for both deck and engineering officers positions.

Not all work at the Academy is on land. For half of the sophomore and half of the junior year, students work aboard a variety of commercial vessels. Students sail from San Francisco, New Orleans, or New York and visit ports around the globe. When on shore midshipmen participate in extracurricular waterfront activities. The Intercollegiate Dingy Team's 60 boats allows these fleets to host the nation's two largest intercollegiate regattas: the Nevins Trophy and the Admiral's Cup. Unlike other colleges, universities or service academies, the students maintain all the vessels in the fleet.

Upon graduation, Academy students face a 5-year maritime service obligation plus a concurrent 8-year commitment that can be fulfilled in many ways. Students have found careers in Admiralty and business law, state and federal government agencies that regulate transport and commerce, marine insurance, stevedoring, customs brokerage, freight forwarding, warehousing, commodities trading, international banking and finance, the Diplomatic service, research. While 65% take jobs at sea, 28% take jobs on shore, and 7% go into the military. A recent survey by Financial Economic Information ranked Kings Point sixteenth among the nation's colleges and universities in terms of the number of alumni who hold top executive positions with major U.S. business firms.

As the Academy celebrates its 50th birthday, it continues its mission to serve when called. Over 140 Academy undergraduates worked on cargo ships in the Persian Gulf in support of Operations Desert Shield/Desert Storm. More recently, two sophomore midshipmen on the Navy-chartered cargo ship ***1st Lieutenant Jack Lumus*** joined in the U.S. humanitarian efforts in Mogadishu, Somalia.

The real payoff at sea in the training received at the Academy comes in the ordinary efficient sailing of vessels on a weatherwise course from point A to point B. As expected, there is always that critical situation that comes up quickly and requires an immediate decision such as the events that faced Captain Joseph C. Mullally II on that fateful night in November of 1988. His S/L ***China Sea*** was steaming for the southern tip of Taiwan when the SOS was received. The ***Golden Park*** was in trouble in an area under the grip of the Northeast Monsoon, which was being intensified by tropical storms. Contact was made and as the crew abandoned the stricken freighter singly and in small groups in the dead of night, Mullally and his crew were there in rough seas risking their own lives. The rescue was further complicated when the freighter's load of logs were dumped into the heaving waters and started bouncing off the hull of the ***China Sea***. Seventeen of the crew of 22 were rescued that night by Captain Mullally and his crew. Kings Pointer Mullally was awarded the American Merchant Marine Seamanship Trophy for 1989.

Whether in times of emergency or in the daily commercial sea travel, Kings Point graduates continue to answer the challenge given by an early mariner, John Paul Jones.

"Sign on and sail with me. The stature of our homeland is no more than the measure of ourselves. Our job is to keep her free. Our will is to keep the torch of freedom burning for all. To this solemn purpose we call on the young, the brave, the strong, and the free. Heed my call. Come sail with me."

Special thanks to Dick DeAngelis, Martin Skrocki, Frank Braynard for their assistance with this article. For additional information on Kings Point Academy, please write: U.S. Merchant Marine Academy, Kings Point, New York 11024-1699.

GMDSS — A Safety Net for Mariners

LCDR Mark Koehn and Lt. Bill Sites
National Weather Service

Many mariners have just recently become accustomed to their new Global Positioning System (GPS) satellite navigation equipment which provides very reliable and accurate navigational fixes to ships anywhere on the world's oceans. Now mariners can plan on high quality Maritime Safety Information (MSI) from practically anywhere on the world's oceans. The International Maritime Organization (IMO) developed the Global Maritime Distress and Safety System (GMDSS) to provide a service such as this. GMDSS began in February 1992 and will be fully operational by February 1999.

Under GMDSS, the National Weather Service (NWS), U.S. Coast Guard (USCG), and Defense Mapping Agency (DMA) have begun to broadcast alphanumeric products to mariners via NAVTEX and SafetyNET. GMDSS was developed by IMO and coordinated with such organizations as the International Hydrographic Organization (IHO) and the World Meteorological Organization (WMO). GMDSS is defined in the International Convention for the Safety Of Life At Sea (SOLAS) 1974, as amended in 1988. These amendments will affect most vessels over 300 gross tons by the year 1999. The goal of GMDSS is to provide emergency and safety communications, and dissemination of MSI, to all ships on the world's oceans regardless of location or atmospheric conditions. This includes navigational warnings, meteorological warnings and forecasts, and search and rescue (SAR) information from both land-based SAR coordinators and participating ships at sea.

For the delivery of MSI, GMDSS consists of two components:

1) **NAVTEX**, which is a medium frequency (518 kHz) radio-based teleprinter system designed to supply safety information to mariners within about 200 miles of the shore.

2) **SafetyNET**, which is an international automatic direct-printing satellite-based service specifically designed for the dissemination of MSI to ships on the high seas as part of GMDSS. It was developed as a safety service of INMARSAT's Enhanced Group Call (EGC) system to provide a simple, automated means of receiving safety information. SafetyNET uses INMARSAT-C to deliver MSI to mariners in all the world's oceans with the exception of the waters poleward of about 75 degrees. SafetyNET is operated in the U.S. by COMSAT.

Under GMDSS, the oceans are divided into four areas (A1, A2, A3, or A4) for the purpose of determining equipment carriage requirements (see illustration at right). In accordance with the provisions of GMDSS, a vessel adhering to the SOLAS Convention must carry a suite of communications equipment depending on the ocean area in which it operates.

Basically, vessels will be required to carry NAVTEX equipment if they operate only within NAVTEX coverage and SafetyNET equipment if they operate outside of NAVTEX coverage. In addition, the following basic equipment must also be carried: VHF radio equipment with Digital Selective Call (DSC), a Satellite EPIRB, 9 GHz SAR Radar transponders, and portable VHF sets. IMO can provide detailed information on GMDSS equipment requirements. Note that not all nations offer a NAVTEX service– several nations, such as Australia, will rely on SafetyNET to deliver MSI to near shore areas.

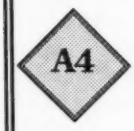
In the U.S., NAVTEX broadcasts originate from 12 USCG facilities and are transmitted according

GMDSS Areas

Area A1: Within range of VHF coast stations (about 20 miles from shore).

Area A2: Beyond A1, but within range of MF coastal stations (about 100 miles from shore).

Area A3: Beyond A1 and A2, but within coverage of INMARSAT (Worldwide except for Polar regions).



Area A4: The remaining sea areas. (Polar regions).

to the schedule shown below. NWS marine weather products broadcast over NAVTEX include coastal or offshore waters warnings and forecasts, depending on the particular area, while USCG products include Local Notice to Mariners. NAVTEX provides MSI to mariners within about 200 miles of Alaska, Hawaii, Guam, U.S. West Coast, U.S. East Coast, Gulf of Mexico, and Puerto Rico.

The SafetyNET satellite transmission system offers MSI with all-weather reliability and accessibility to all properly equipped vessels under the coverage area of the satellite– known as the satellite's footprint. To receive a SafetyNET transmission, a vessel must have a GMDSS type-approved INMARSAT-C transceiver aboard and initialized to receive information for the proper GMDSS Area(s). There are 16

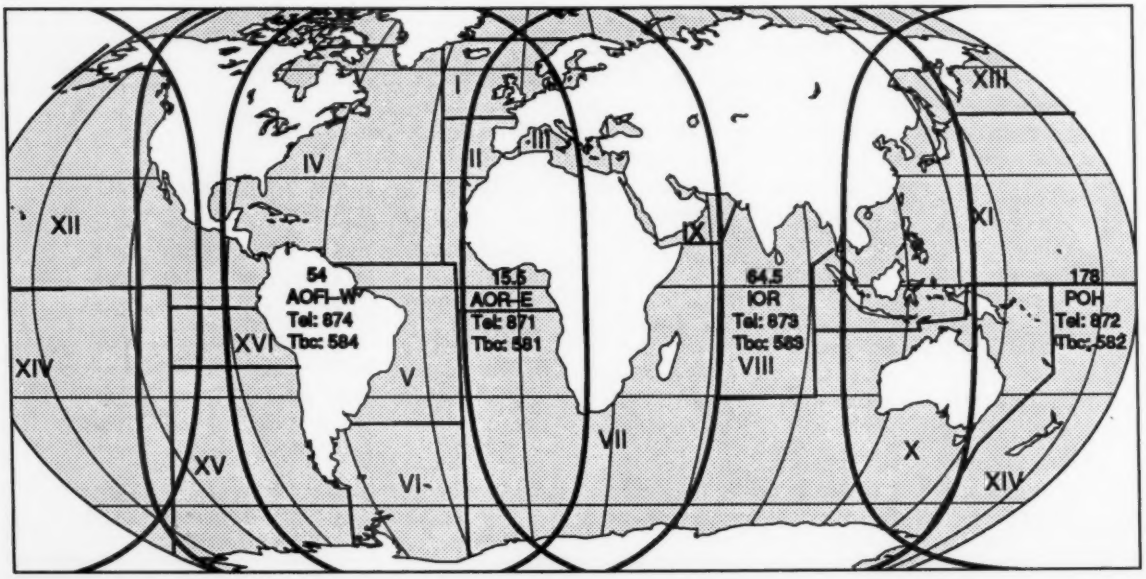
NAVTEX Broadcast Schedule

Station	ID	Broadcast Times (UTC)					
Boston, MA (NMF)	F	0445	0845	1245	1645	2045	0045
Portsmouth, VA (NMN)	N	0130	0530	0930	1330	1730	2130
Miami, FL (NMA)	A	0000	0400	0800	1200	1600	2000
New Orleans, LA (NMG)	G	0300	0700	1100	1500	1900	2300
San Juan, PR (NMR)	R	0200	0600	1000	1400	1800	2200
Honolulu, HI (NMO)	O	0040	0440	0840	1240	1640	2040
Guam (NRV)	V	0100	0500	0900	1300	1700	2100
Kodiak, AK (NOJ)	J	0300	0700	1100	1500	1900	2300
Adak, AK (NOJ)	X	2340	0340	0740	1140	1540	1940
San Francisco, CA (NMC)	C	0000	0400	0800	1200	1600	2000
Long Beach, CA (NMC)	Q	0445	0845	1245	1645	2045	0045
Astoria, OR(NMC)	W	0130	0530	0930	1330	1730	2130

GMDSS MSI broadcast areas as shown below. (These areas are also referred to as NAVAREAS or METAREAS by the hydrographic and meteorological communities, respectively). The microprocessor within the shipboard INMARSAT-C transceiver determines in which MSI area the vessel is located (based on input of the vessel's position) and retains only those products addressed to vessels in that area. For example, say your ship is located near 40°N, 160°W, is equipped with an approved and properly initialized INMARSAT-C terminal, and the ship's position has been entered into it and updated either manually or electronically by GPS input. Then you will receive MSI for Area 12 at the scheduled broadcast time. Note that some INMARSAT-C receivers are capable of receiving MSI from two MSI broadcast areas for voyage planning purposes. SafetyNET was designed to operate unattended around the clock and deliver a printed copy of the SafetyNET message to properly initialized INMARSAT-C receivers. GMDSS will operate in parallel with the present radio-based system of disseminating warnings and forecasts until February 1999. After that time, GMDSS will become the primary international means of distributing MSI to mariners.

Shippers will be pleased to know that INMARSAT-C, in addition to serving as a platform for receipt of MSI, is a commercial digital maritime service which offers Telex capabilities at a lower cost than is available on INMARSAT-A. The basic INMARSAT-C transceiver has no input or output devices attached, only a small antenna, but allows for several configurations, such as the addition of a printer, terminal, or personal computer (PC). Many configurations include a PC for simplifying transmission and receipt of ship's Telex message traffic. Also note that ship's weather observations can be sent to the NWS, or other meteorological service, via INMARSAT-C using the "code 41" dialing procedure similar to INMARSAT-A. You can reduce communications costs to the NWS by more than 50% by sending observations via INMARSAT-C versus INMARSAT-A. Reducing costs for observations provides the NWS with the flexibility to improve or expand maritime services. NWS is, of course, very pleased with this news!

METAREAS/NAVAREAS



GMDSS Questions

What is the time frame for GMDSS?
Beginning on February 1, 1992 you can either comply with GMDSS or SOLAS '74 until February 1999. By August 1, 1993, all ships will be required to carry EPIRBS & NAVTEX. All ships built after February 1, 1995 must comply with all GMDSS regulations and by February 1, 1999 all ships (300 gross tons or more) must comply with these regulations.

How does SafetyNET work– how does the National Weather Service High Seas Bulletin or DMA Navigational Warning get to your ship ?
The National Weather Service, Defense Mapping Agency, and U.S. Coast Guard are working together to deliver MSI to ships at sea through COMSAT's two Coast Earth Station's (CES): one in Santa Paula, CA for access to the Pacific satellite, and one in Southbury, CT for access to the Atlantic West satellite. COMSAT provides the link from NWS, DMA, and USCG to ships at sea by way of the INMARSAT satellite system. While the system is complicated, it will be entirely "hands–off" when it is fully implemented, and will reliably provide MSI regardless of atmospheric conditions or location of your ship (unless you are poleward of about 80 degrees).

What NWS and DMA products are routinely broadcast over SafetyNET ?
The NWS marine products delivered by SafetyNET, under GMDSS, are the High Seas Bulletins issued for both the Atlantic and Pacific ocean areas. These bulletins include storm warnings, synopsis of major features, and forecasts. DMA delivers navigational warnings to NAVAREAS 04 and 12 over SafetyNET between 1300 and 2100 UTC, normally after they have been broadcast over HF radio. DMA is developing a routine SafetyNET broadcast schedule and plans to make it operational by May. The broadcast schedule that is currently in place for NWS products is as follows:

PRODUCT	METAREAS	BROADCAST TIMES (UTC)
NW Atlantic Ocean	04	0430, 1030, 1630, 2230
NE Pacific Ocean	12	0545, 1145, 1745, 2345
SE Pacific Ocean off Peru	16	0515, 1115, 1715, 2315

The NWS will also continue to prepare and issue High Seas Bulletins every 6 hours for radio–based broadcasts until February 1999. Currently, the bulletins are disseminated by the USCG and selected commercial radio stations using HF radio in accordance with the schedules published in Selected Worldwide Weather Broadcasts. Beginning in late 1992, these methods of dissemination were augmented by SafetyNET. Recall that receipt of a radio broadcast is dependent on atmospheric conditions, distance from transmitting unit, power output, and angular coverage of the transmitter, and normally require having a radio operator on duty. With satellite communications, these limiting factors can be eliminated.

Are weather graphics available over INMARSAT?
Not yet. However, with the availability of satellite broadcast technology, it is apparent that the INMARSAT–C system, or other satellite–based system, offers possibilities to support the transmission of weather graphics to mariners. Graphic capabilities may be accomplished through facsimile broadcast, transmission of digital field data to shipboard computers for application to existing map bases, or some other system.

Questions or comments regarding the National Weather Service's participation in the Global Maritime Distress and Safety System can be addressed to:

LCDR Mark Koehn or LT Bill Sites
NWS, W/OM12, SSMC2, Room 14112
1325 East–West Highway
Silver Spring, MD 20910.

Old Harbor Life–Saving Station

Elinor De Wire
Mystic Seaport

Chatham, a small but distinctive Yankee town at the *elbow* of Cape Cod, Massachusetts overlooks the sea at the northern reaches of the dangerous Monomoy Shoals. Except during the summer months when tourists visit its streets and beaches, Chatham is quaint and quiet today. But, in colonial days the sleepy little village had a less charitable reputation. Some said it was a haven for heartless "mooncussers," men who relished moonless nights when they could set false lights along the shore and plunder unwary ships that were lured onto the shoals.

The ruthless wreckers of Chatham were probably more the outgrowth of legend than fact, but even without their misdeeds the waters around Chatham were treacherous–the worst along Cape Cod and among the most hazardous on the Atlantic Seaboard. For this reason, and perhaps to also supplant its grisly reputation, five lifesaving stations were established in this vicinity in the late 1800s, all within a stretch of about 15 miles.

The closest to Chatham was Old Harbor Lifesaving Station built in 1897 on a strand of barrier beach at the opening to New Harbor and Pleasant Bay. Like its sister stations along the backside of Cape Cod, Old Harbor was exposed to the full strength of 3,000 miles of open sea and, from its first day of service, was also threatened by erosion. Blowing sand frosted the windows and smoothed the wood shingles;

MAP OF CAPE COD, SHOWING LOCATIONS OF U.S.L.S. STATIONS
Small circles show where principal wrecks occurred during the period from 1850 to 1900.

Originally built in 1897, Old Harbor Station is seen here in 1914 at its original site on a strand of barrier beach near the opening to New Harbor and Pleasant Bay outside of Chatham, MA. When threatened by beach deterioration 63 years later, the station was lifted and moved to firmer land at Race Point. Today it is used as a museum highlighting the heroism of New England life station keepers. Photograph was generously loaned to us by Richard G. Ryder, author of ***Old Harbor Station****.*

during storms, waves stole sand from beneath the foundation and deposited it somewhere else down the beach.

The station is believed to have been built by a firm in Portland, Maine at a cost of $4437.52. It was similar to other lifesaving stations in the area and consisted of a spacious main house with a watch tower rising from the roof, a boathouse, a stable for the horses, and several smaller auxiliary buildings. The surfmen lived in the main house, but each had a dory for getting back and forth to the mainland to visit his family. Furnishings were spartan, and there was no electricity, indoor plumbing, or central heat when the station opened in 1898.

Old Harbor's premier head keeper was 52-year-old Captain Hezekiah Doane, who transferred from Chatham Lifesaving Station and remained at Old Harbor until 1915. With 18 years of experience, Doane's salary in 1904 was $75 a month. The six surfmen assisting him each one earned $65 a month. During his tenure in charge, he colorfully recorded in the station logbook the daily work of the crew and any events of note, including rescues.

Patrols and watches were conducted every day, along with a count of the number and types of ships that passed: On November 12, 1904 sixty-eight schooners and two steamers were sighted. But each day of the week except Sunday also saw the men doing chores and drills. Mondays appear to have been cleaning days, Tuesdays were devoted to Surfboat Drills, on Wednesdays it was "Signal Drill" and on Fridays it was "Resuscitation of the Apparently Drowned."

Captain Doane reported that between November 29 and December 6, 1898 seven bodies washed up near the station house, drowned in the Great Portland Gale. The winter of 1899 was brutal too, with a February 13th blizzard bringing dangerously high tides, ice cakes, and beach erosion that prevented the patrols between Old Harbor and Chatham stations from completing their beats. The following day Captain Doane reported "Crew employed shoveling snow from the building."

A number of rescues were made by the Old Harbor surfmen, mostly using the surfboat, but a well-known breeches buoy rescue was accomplished in a February 1902 snowstorm when the 112-ton

fishing schooner, ***Elsie M. Smith*** wrecked in the darkness on Orleans Beach just north of Old Harbor Station. Eighteen were aboard, and most panicked when the hull ruptured and flooded. The skipper sternly ordered everyone to seek safety in the rigging until help arrived, but five men refused. They commandeered two dories and lowered themselves into the raging surf. As the rest of the crew watched in horror, both boats capsized. Only three of the five made it to shore.

Beach patrols from the Orleans and Old Harbor stations sighted the wreck shortly after it hit and immediately notified their stations via telephone from a halfway hut they used to exchange tokens (proof that they had completed their beats). Within 20 minutes the Old Harbor crew was on the beach opposite the wreck. A line was fired to the vessel, about 150 yards offshore, the hawser pulled across, and the breeches buoy sent out. Within 3 hours all the remaining men on the wreck were safely ashore and on their way to the warmth of the two lifesaving stations. The bodies of the two drowned crewmen were found the next day and buried in a cemetery in Chatham.

In 1915 all lifesaving stations, including Old Harbor, were merged with the Revenue Cutter Service to become the U.S. Coast Guard. Captain Hezekiah Doane retired a few weeks later, but the station continued in service another three decades. In the years that followed, advancements in lifesaving—mainly motorized boats and helicopters—upstaged beach carts and surfboats. In addition, better navigational instruments and ship maneuverability meant fewer wrecks.

On July 1, 1944, the Old Harbor Lifesaving Station was officially decommissioned. The station was later sold as government surplus and purchased by a family who used it as a fishing lodge and camp. By 1973 when the National Park Service (NPS) purchased the historic building for $44,935 (more than ten times its original cost), the high tide line was within ten feet of the station's front door, but no additional funds were available to move the structure, so it remained on the beach, rapidly deteriorating and threatened by every storm that passed.

The Old Harbor Station as it appears today. As Ross Holland of the National Park Service noted: "The station is a symbol of man's humanity to man. The establishement of the Life-Saving Service is one of the finest things that the government has ever done. It reflects a time when man thought about his fellow man. These buildings deserve far more than the battlefield to be hallowed."

By 1977 the sea was swirling underneath the east foundation of the station. NPS secured funds to relocate the structure, and just before the winter storm season arrived the Old Harbor Lifesaving Station was loaded onto a barge and towed to Provincetown. There it waited through the winter while its former location was filled in with sand and the lifting cranes were brought up the cape to move it off the barge. The following spring it was lifted onto a firm, dry land foundation at Race Point. Repairs were made, a board walkway was built to provide access from a nearby parking area, and interpretive displays and kiosks were added.

An epilogue to the story of Old Harbor Station was the publication of its history in 1990 by the grandson of one of its early surfmen. Richard E. Ryder served at the station from 1906 to 1915, then returned in 1932 as head keeper. His grandson, Richard G. Ryder, obtained the station logbook some 50 years later. He made a thorough inventory of all the equipment and furnishings mentioned in the log and pieced together the chronology of events at the station from its inception to decommissioning. More important to him was to discover in the National Archives a yellowed, handwritten letter signed by Richard E. Ryder, the grandfather he never knew. Richard G. Ryder's *Old Harbor Station* is available through Ram Island Press, 29 Cuprak Rd., Norwich, CT 06360.

Old Harbor Lifesaving Station is seasonally open to visitors as part of Cape Cod National Seashore. For information on accessibility call the Visitor Center at (508) 487-1256.

The *Celtic*

Skip Gillham

For 18 years the ***Celtic*** had safely navigated the deep and temperamental waters of the Great Lakes and had always returned safely back to port. Unexpectedly, the shallowest waters of Lake Huron would prove fatal to this 19th century vessel.

The ***Celtic***, a 140–foot wooden passenger and freight carrier, was built at Hamilton, Ontario in 1874.and originally operated on Lake Ontario.

Its last voyage began in late April of 1892. The ***Celtic*** cleared Fort William, Ontario, which is now part of Thunder Bay, on its way to Kingston on Lake Ontario. The ship navigated Lake Superior and Lake Huron safely but soon ran into difficulty.

The warm air of spring passing over the still cold waters of Lake Erie created a great wall of fog that engulfed the ***Celtic*** and made navigation difficult.

On May 1, 1892, just east of Rondeau, Ontario, the ***Celtic*** slid through the mist and collided with the steamer ***Russia***. It sank taking with it one crew member.

The steamer ***Russia*** was beached as a reult of the collision but eventually repaired. It too became a casualty during a gale on Lake Huron in April 1909.

The photograph of the ***Celtic*** at Duluth is courtesy of Milwaukee Public Library.

AVHRR Satellite Imagery

Paul Reilly
National Ocean Service

Hurricanes and tropical storms, once formed, gain and maintain their intensity largely by taking thermal energy from the body of water over which they are traveling. As the surface temperature of the water gets cooler, the intensity of the storm tends to diminish. Research has found that the optimum sea surface temperature for this development will be approximately 26–28°C. Last summer Hurricane Andrew confirmed some of this research.

After leaving the Florida Peninsula on the 25th of August 1992, Andrew made its way across the Gulf of Mexico, making a clockwise arc before making landfall on the south coast of Louisiana on the 27th of August.

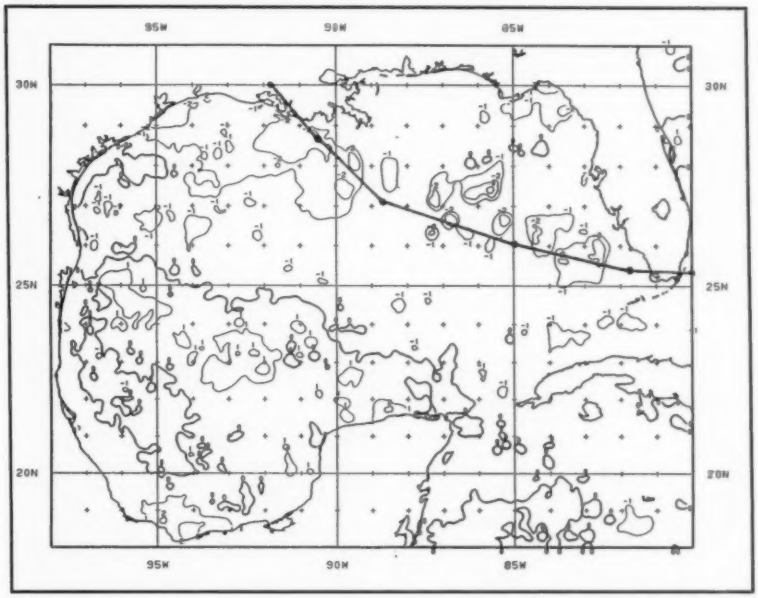
During the period the system moved across the gulf, Sea Surface Temperatures (SSTs), were favorable for the hurricane to increase in strength or at least maintain its present intensity. The SSTs for the Gulf during the summer displayed a slight temperature inversion in the Loop Current. The Loop Current (LC), coming north from the Caribbean Sea between Yucatan and Cuba, is usually slightly warmer than the Gulf of Mexico. During this period, the LC was slightly cooler than the Gulf in general. Other than this, the Gulf surface waters were approximately isothermal throughout (28–30°C), with no significant discernible ocean features.

As the hurricane moved across the Gulf, it brought about vertical thermal mixing and other oceanographic processes all resulting in cooler SSTs along the immediate path. The illustration on the top right is a satellite SST composite chart for the area between 18th and 29th of August with the hurricane track superimposed. The illustration on the bottom right is an Ocean Features Analysis (OFA) for the 1st of September 1992, from NOAA's National Ocean Service. It was taken from AVHRR infrared NOAA 11 satellite imagery, two to three days after the eye of the system hit the Louisiana coast.

Comparing the two figures, there are cooler areas in the northeast quadrant of both charts. It is likely that the cooler area found on the 1st of September between approximately 83° and 90° west, is the "distorted" path of the storm formed during the 25th to 27th of August. During the period 27th to 31st of August, cloud cover precluded additional data. Since most of the gulf was nearly isothermal at the time, indications of the LC were difficult to discern. This swath of cool surface water with its characteristic shape could reflect the influence of the LC. The bottom illustration shows that near "A" and "B," the temperature are similar, whereas area "C" is slightly cooler, indicating the LC position days before. The contrast observed in the immediate area around "C" is a weak indication of the slightly cooler LC, which had been noted during the previous weeks. The area around "B" does not appear to be the Loop Current since the best satellite indication place the north wall of this current hundreds of miles south many days before. Yet, could the Loop Current dynamics allow for horizontal movement of water other than LC into this area?

There continues to be a considerable amount of research taking place in the gulf, most notably Louisiana–Texas Physical Oceanography Program (LATEX). This comprehensive project, with a heavy emphasis on physical parameters, could possibly assist in confirming these observations and answering this question.

SST Differences, Hurricane Andrew



The Sea Surface Temperature differences (°C) in the chart at right are those found on the 29th of August by AVHRR Satellite Imagery subtracted from those found on the 18th of August. The negative anomalies therefore represent a cooling of surface temperatures most likely caused by the passage of Hurricane Andrew. Note the negative (cool) anomalies north of the eastern portion of the track, off the west coast of Florida.

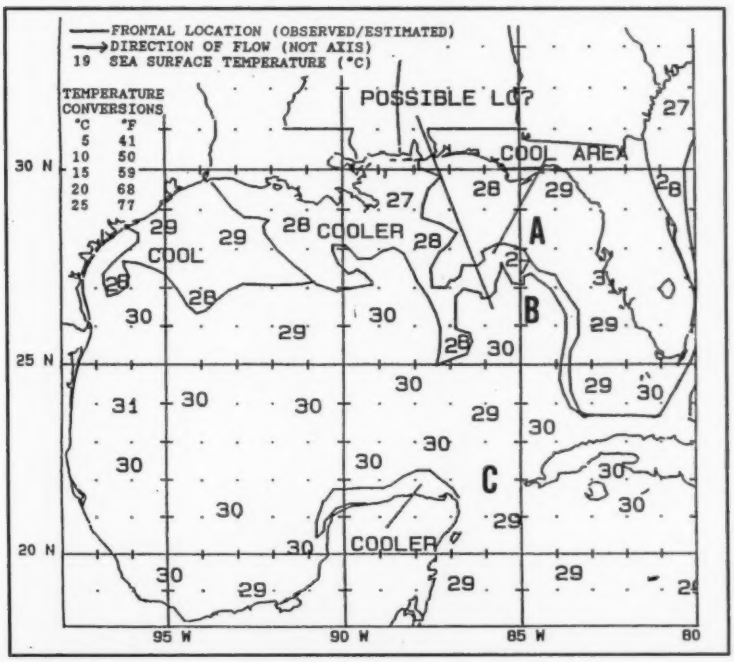
The AVHRR Satellite imagery is archived at the National Climatic Data Center. For additional information write:

Chief, Satellite Data Services Division
Room 100, Princeton Executive Square
5627 Allentown Rd., Washington, DC 20233
or call (301) 763-8402.

The Ocean Features Analysis Charts are derived from several images. The resolution of image data used in the analysis varies from 1 to 8 kilometers. These charts are sent daily to the National Climatic Data Center for distribution to users. These charts are available for 3 months, 6 months or 1 year subscription via land facsimile or mail. For further information write:

NOAA/ National Climatic Data Center
Federal Building
Asheville, NC 28801-2696
or call: (704) 254-0619.

Ocean Features Analysis, September 1, 1992



Paul Reilly is editor of a NOAA publication entitled ***Oceanographic Monthly Summary****. This is a joint publishing effort by the National Weather Service, The National Environmental Satellite, Data, and Information Service, and the National Ocean Service. It contains sea surface temperature analyses on both regional and ocean basin scales for the Atlantic, Pacific, and Indian Oceans. These analyses are based on a "blend" of in situ and satellite data, in which in situ data are used to define benchmark temperature values in regions of frequent observations and satellite data are used to define the shape of the field between these points.*

For more information or to find out how to subscribe to the ***Oceanographic Monthly Summary*** *write:*

NOAA/NOS
Ocean Products Branch
5200 Auth Rd., Room 100
Camp Springs, MD 20746
or call: (301) 763-8294

Composition

Michael Halminski
Photographer

One of my pursuits as a photographer is to convey the dynamic impression of the ocean environment in a photograph. One needs to keep in mind that our senses come into play as we evaluate a scene. We hear the wind, the waves, the birds. We smell the salty air and are surrounded by the vastness of the moment. But take a photograph of this and we are frequently disappointed that it lacks the power of the experience.

What the human eye sees, and what the camera sees are not the same. To see as the camera sees, I try to suppress my senses somewhat and rely only on my sight. I disregard, for the moment, that my subject has depth. I look at it in one flat dimension, as it will appear on paper. An easy way to do this is to cover one eye and view the subject in monocular vision, as is the camera's lens. I

like to isolate a scene in my viewfinder and move it around until I think I have the strongest image.

Using a card with a rectangular window cut out is another interesting and useful approach to view subject matter. This separates the subject from its surroundings and makes it possible to see things out of context, as the final print will be. Hold the frame close to the eye to simulate a wide-angle perspective, and away from your eye to give a more telephoto effect.

The photographer can emphasize certain aspects of a photograph by placement of subject matter. Study the subject's composition and arrangement of its components. Do the dominant shapes lend themselves to a horizontal or vertical format? What is the focal point or center of interest? Should it be high or low, near one side or the other, or in the middle? Each placement will produce a different impression. The more centered, the more static the composition becomes while the more off center the composition, the more dynamic the effect.

The horizon is important because it divides the picture into two parts. The lower horizon, the greater the area of sky, gives a more open, spacious impression. On the other hand, the higher the horizon, the heavier, the earthier the impression becomes. The more predominant one or the other is, earth or sky, the more emphatic the composition. When the horizon line divides the picture equally, emphasis is subdued and composition becomes static. Although sometimes frowned upon, this equal division of earth and sky can be artistically significant when the photographer is trying to convey simplicity or tranquility. In the photograph on the back cover of the Log note the position of the ship (focal point) in relation to the center and horizon line through the middle of the photo.

In order to capture the essence of a subject like the ocean, a photographer needs to be observant, alert, and able to anticipate peak moments. This may require shooting numerous exposures in an attempt to get your best shot. This is the reason that professionals use so much film. If you get that one important picture, then it's worth it.

Beachscape–two impressions: in the vertical (right) note how the sea oats lend themselves to this format and the emphasis is on the detail on the foreground. I think this is a stronger composition than the horizontal shot. In the horizontal format (left), the main emphasis is drawn from the sea oats out to the open beach. This photograph is the same scene as the vertical but gives a different impression.

Point Cabrillo Lighthouse

Elinor DeWire
Mystic Seaport

In the halcyon days of the early 20th century, the coastwise sailors along the northern California shore were greeted near Mendocino by what at first appeared to be a quaint country church with a lamp flickering sleepily in its steeple. But this picturesque beacon had the more practical mission of guiding the doghole schooners of the Pacific Northwest lumber trade.

Point Cabrillo (kə-ˈbril-ō) Lighthouse certainly could have been mistaken for a seaside chapel and its caretaker a minister of deliverance. Such metaphors are easily attributed to lighthouses. Throughout its 65-year career the sentinel prevented numerous marine disasters. The few that did occur were expertly handled by the station's keepers and the crews of the nearby Coast Guard patrol and rescue units.

The light that served the lumbermen was appropriately constructed of wood except for its iron lantern. The beacon itself was a flashing third order lens atop a 47-foot octagonal tower attached to one end of the fog signal house, where twin foghorns called seaward through the murk that frequently plagued the area. Point Cabrillo often logged more than 1000 hours of fog a year.

Three handsome houses one for the principal keeper and one for each of his two assistants sat back from the lighthouse surrounded by bent, gnarled cypress trees and several small outbuildings. The whole complex was situated on a dramatic, spray-dashed cliff reminiscent of the coast of Cornwall in England.

Wilhelm Baumgartner appears to have been the station's first keeper. He was no doubt pleased with such a pleasant assignment for Point Cabrillo Lighthouse was not as cloistered as many of its companion sentinels on the West Coast, nor as dangerous. The access road was clear and smooth, and the comforts of civilization were close by—a school, stores, a church, a doctor, and friendly neighbors.

Like all lighthouses, this one had its drawbacks. Fog was persistent, demanding that the sirens be put to work on the station's first night of duty. Wind blew almost incessantly, causing the hunched-over stance of the trees, tatters in the station flag, and havoc for the laundry on the clothesline.

A severe storm would throw waves over the point and heavy rain would soak the erosive cliffs and made them crumble underfoot. The ceilings of wave tunnels that coursed under the point could also collapse during wet weather. One keeper's cow fell victim to the unpredictable terrain at Point Cabrillo when the ground gave way beneath her and sent her tumbling down the cliffs into the

U.S. Lighthouse Society

Point Cabrillo Lighthouse looks like a small New England chapel although it rests on a peninsula outside of Mendocino, California, about 24 miles north of Point Arena in northern California. The light is 84 feet above the water.

sea. Fortunately for the cow, the keeper was able to rescue her.

A more serious consequence of the point's precarious topography was the near death of keeper Harry Miller in the 1940s. Miller, as other keepers before him, was plagued by flooding in the basement of his house when rains were heavy. He and his assistant, Thomas Atkinson, decided to dig a trench behind their homes to carry the rainwater into the sea.

When the digging reached a depth of about 8 feet Miller suddenly felt the bottom of the pit falling away beneath him. Sinking in the saturated sand, he was quickly mired up to his knees. Atkinson, realized his friend was being sucked into a subterranean cavern and grabbed Miller's arms and pulled. Miller's feet came out of his boots with a loud whoosh, and he clambered up the walls of the pit in his socks, thankful to be alive.

In 1952 veteran lightkeeper Bill Owens came to the station with his wife, Isabel. The parents of four lively daughters, they had served at several other California lighthouses and would be the last civilian family assigned to Point Cabrillo. Owens' tenure was relatively uneventful until February 8, 1960 when a savage storm arrived from the west and pounded the point.

Owens and his assistants had turned on the beacon a few hours before the storm hit, and one man had gone on watch in the small building adjacent to the lighthouse. As steady westerly winds pushed against the shore, the seas heightened and began breaking over the point. Spume so obscured the light that the keeper on watch knew the fog signal must be turned on. The ground around him was awash and he was unable to go to the building that housed the horns.

The storm raged throughout the night and much of the following day and the light operated on its own. When the fury abated, the landscape was strewn with debris and rocks, some of them weighing as much as 2 tons. The seaward side of the lighthouse had been stripped of its siding, and the doors to the fog signal rooms had been smashed. A generator and air compressor were pushed to one side of the room, and nearly a foot of pebbles and sand covered the floor. Fortunately, the beacon had weathered the storm and was still operating.

Resident lightkeepers continued to tend the 35-acre Point Cabrillo Light Station until it was automated in the 1970s. Like

many self-sufficient lighthouses, it was then locked and the property around it posted with warnings against trespassing. Soon after it closed, concerns over the future of the point were raised especially on issues of subdivision and residential development.

In 1978 the California State Coastal Conservancy was enlisted to help establish a workable plan for the preservation of Point Cabrillo. The Conservancy was able to acquire the property around the lighthouse from the Coast Guard and then purchase privately owned land bordering the station. Public use guidelines for the point were established and a plan developed to carry them out. The final chapter in the Point Cabrillo story is yet to be written and will likely depend on the amount of funds raised to preserve the old station.

The Conservancy envisions the development of an educational park where whale-watching, beach activities, natural history tours, and a small museum are enjoyed by visitors to the lighthouse. The station's original Fresnel lens is still intact although it has been upstaged by a strobe beacon, and the buildings are in good shape. West Coast lighthouse historian Ralph Shanks describes Point Cabrillo as "the best example of a complete, old-time light station in northern California."

Additional information on the Point Cabrillo Project is available from:

California State Coastal Conservancy
1330 Broadway Suite 1100
Oakland, CA 94612-2530.

The wide angle photo (above) shows the whole sweep of land at Point Cabrillo. Lighthouse, outbuildings, and three red and white Victorian houses face the wide Pacific Ocean. Surrounding the houses are the wind-sculpted bank of cypress trees.

The aerial view of Point Cabrillo shows only part of the 300-acre property. Sturdy savannah grass and cypress trees cover the area around the lighthouse and surrounding buildings. A road crosses to the lighthouse with deep sea caves on either side. Both photographs courtesy of the California State Coastal Conservancy.

Interviews, Awards and News

Getting to Know a British PMO

Captain Clive R. Downes

Since British PMOs have Captains in their titles, is this a longstanding requirement?

It has always been a requirement that British Port Meteorological Officers hold a Master Mariner's Certificate of Competency (Foreign Going) and have had considerable sea-going experience, preferably in Voluntary Observing Fleet (VOF) vessels. Most of them have been in command of a merchant vessel and hence have the courtesy title of Captain. There have been exceptions, however. The former PMO in Liverpool, who retired about 2 years ago, had taken up his post after many years of service in Ocean Weather Ships as a navigating officer, but since he'd never been in command he was not referred to as Captain.

What's your background?

I left school at the age of 16, in 1949, and did my pre-sea training in H.M.S. ***Conway***, one of the major sea training colleges at that time. On graduating in 1951, I was apprenticed to Shaw Savil Line, a major British shipping company with a fleet of passenger and cargo liners trading between Europe and Australasia, most of which were part of the British VOF. I remained with this company for the whole of my 23 years at sea working my way up through the ranks until I was promoted Master in 1966.

My first command was the ***Cymric***, a refrigerated cargo/passenger ship of 11,000 tons gross, built in 1953. My first voyage as Master will always remain vivid in my memory. Within a few days of sailing from Liverpool, the vessel ran into a decaying hurricane just south of the Azores which earned us a mention in the *The Marine Observer* (October 1967). I left sea in December 1974 and joined the Meteorological Office as a Nautical Officer in April 1975, and for the next 8 years. In addition to other duties, I was Deputy Editor of *The Marine Observer*, based in Bracknell. In Septem-

ber 1983, I was promoted and posted to a senior Port Meteorological Officer in the southeast of England as Port Meteorological Officer.

I've heard that the formal PMO program in England has a long history. How far back does it go?

The British Meteorological Office was established as a department of the Board of Trade in 1854 under Admiral FitzRoy. By 1855, 120 ships of the Royal and Merchant Navies were recording observations in a "Weather Register," the forerunner of the present-day Meteorological Logbook. In the early days, the necessary instruments and stationery were probably issued direct from the Office. However, our records show that a PMO was possibly established in Liverpool in about 1883; presumably the London area was still covered by Headquarters. There were probably Port Meteorological Agents appointed in the major ports–Cardiff, Southampton, Hull, and Glasgow. The agents appear to have been ex-mariners and were probably cargo surveyors who undertook Meteorological Office duties on a fee-paying basis. PMOs at all the major ports as now were not established until after World War II.

The British PMOs seem to value cooperation with PMOs in other countries. Is this true, and what are the advantages?

British PMOs have always fully cooperated with the PMOs of present and past Commonwealth countries, particularly with those of Canada, Australia, New Zealand, India, Singapore, Hong Kong and South Africa, and have always visited ships which belong to the VOFs of these countries. With the recent decline of the British merchant fleet, it has become necessary to recruit many foreign flag vessels, many of which have no regular trading pattern. To service our present VOF, it has become necessary to ask for cooperation of PMOs in other countries, who very kindly hold small stocks of our instruments and stationary, in supplying vessels or our VOF which may be away for prolonged periods. Following the visit of our Marine Superintendent to the U.S. PMO's Conference a few years ago, the Marine Observations Program Leader generously agreed that several PMOs in the U.S. would hold British stocks for the same purpose. British PMOs now also routinely visit vessels of foreign VOFs to offer barometer checks and any other assistance we can give with regard to marine meteorological observing. I also visit vessels which do not belong to any VOF, not only in the hopes that the officers can be persuaded to make meteorological observations but also to offer a barometer check and supply details of our meteorological services for shipping.

What ports does your territory encompass?

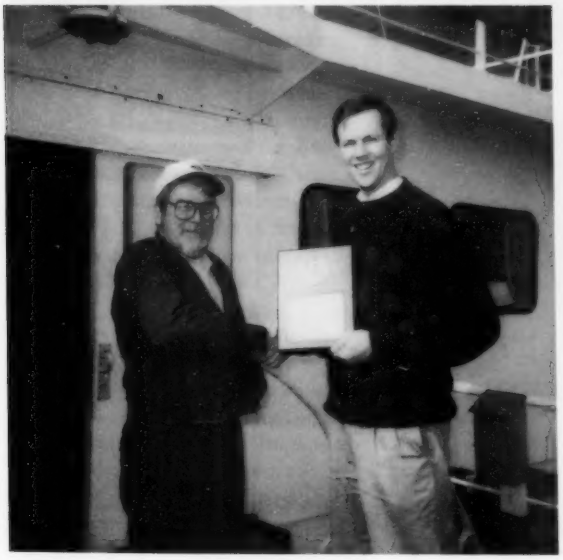
As PMO for Southeast England, I cover the main ports of Great Yarmouth (about 120 miles to the north), Lowestoft, Felixstowe, Harwich, London (including the river berths on the Thames), the Medway ports of Sheerness, Thamesport, Chatham and Rochester and, finally, Dover (about 80 miles to the south). There are, of course, other minor ports in between and these I visit from time to time.

As far as you know, do British PMO duties differ from those of their American counterparts?

As far as visiting ships is concerned, I do not think that my duties markedly differ from those of my American counterparts. However, in addition to this task, it is part of my duties to maintain a close liaison with the principals of the shipping companies, the principals and lecturers of nautical colleges and the Harbour Masters and operative officers of the various ports in my area. I also maintain a close connection with the senior officers of the various ports and maintain a close connection with the senior officers of Trinity House regarding the fitting of automatic weather stations on some of the Light Vessels established around the coast. It is my duty to obtain the views of the shipping industry on the meteorological services provided by the British Meteorological Office under the SOLAS agreement and also to promote the commercial services of the Meteorological Office with particular regard to marine climatology and weather routing of ships.

Can you tell us a little about your family and your outside hobbies?

My wife, Margaret, and I have been married for 33 years. Margaret teaches 5-year-olds in the local school. My elder son, Stephen, has just obtained his Ph.D in music and is seeking a post in university lecturing. My daughter Alison is married and works as a dietician in Bristol; Andrew, my younger son, recently graduated from the University of Oxford and is now training to be a Chartered Accountant with an internationally known accountancy company.
I am a church warden of the Anglican church in my village, the duties of which take up a considerable amount of my free time. When possible I also enjoy working on my model railroad which I have been building up for some years now.



Above left, Earle Ray Brown, Jr, PMO Norfolk, presents the annual VOS Award for outstanding observations during 1992 to Capt. Daniel R. Murphy aboard the ***PFC William B. Baugh.*** *The award is based upon the overall performance of a vessel's observation program for the year.*

Capt. Daniel Murphy, looking even happier, receives congratulations on receiving the VOS Award from University of VA student, Christina Coleson (photo right). PMO Brown acted as mentor through the Extern program to Coleson, who is considering a career in the Environmental Sciences.

PMO Ray Brown's Extra Duties

PMO Ray Brown took on the role of career mentor to University of Virginia junior Christina Coleson as part of the university's Extern Program in early January of this year.

The Extern Program was created to give students practical experience in a chosen career. Banks, hospitals, brokerage firms, advertising, and entertainment industries including Spike Lee's production company, 40 acres and A Mule, have welcomed UVA students and helped them learn more about a career field. On a volunteer basis, the students agree to assist their sponsor on projects or short term activities while they're observing. The students pay for all their week long expenses and generally work during school breaks or during summer vacations.

Coleson, a Portsmouth, VA, native is considering work in the Environmental Sciences. She saw the Externship as an immediate benefit in deciding on what subjects to take as well as future possibilities.

On her application to the program, she wrote, "The externship will help me decide what concentration I want to focus on in the Environmental Science major." But, she also saw it as a chance to "make future contacts for employment, as well as references for jobs."

Brown enjoyed the opportunity to help Coleson learn about the NWS and the PMO program. "Christina accompanied me on my normal ship visitations, which in itself is quite a physical workout, unexpectedly probably for an NWS tour. She worked with me the whole week, on occasion, more than the normal 8 hour day. We visited the Atlantic Marine Center. She met the recruiter, the Admiral in charge of the base, and of course, was on all of the ships in port at that time. We also went to the Naval Oceanographic Center at the Navy base in Norfolk. Career opportunities were discussed at both these offices," Brown said.

Was it the Storm of the Century?

Editor and Friends

Was the Blizzard of '93 the *Storm of the Century*, the *Mother of All Storms* or the *White Hurricane*? Or was it a lot of media hype? First, and most importantly, it wasn't media hype. In fact it was one of the most severe, best forecasted winter storms to ever hit the eastern United States.

Adjectives abound in meteorological jargon. There are Great Hurricanes, Super typhoons, freak waves, torrential rains, and frigid temperatures to mention but a few.

This report should be considered preliminary and is based upon summaries provided by the National Climatic Data Center, mariners, the Weekly Weather and Crop Bulletin and some of our readers. It is intended to provide information that often doesn't get out to the marine community. We will of course publish a final summary with official statistics when it becomes available.

Some have been quantified while others are subjective, impossible to pin down. In England, in 1987 they had their *Storm of the Century*, which was followed a few years later by a second *Storm of the Century*. Labeling these storms is similar to labeling great athletes. Gretzky was the greatest hockey player of all time until Lemieux who may be until Lindros or Selanne.

Some will argue that the *Knickerbocker Storm* or the *Blizzard of 1888* were the greatest to ever hit the East Coast of the United States, while others will argue in favor of the March 1962 storm, and just a month or two ago there was even a few votes for the storm in December of 1992. However, after all the records are tallied and analyzed this March Storm of 1993 will go down as one of the most severe East Coast storms on record. The statistics are still being collected analyzed and verified, but we have already received so much mail on this storm that we felt it would be appropriate to publish some of the records and accounts that might otherwise go unnoticed. First a brief summary for those who might not have heard about this system.

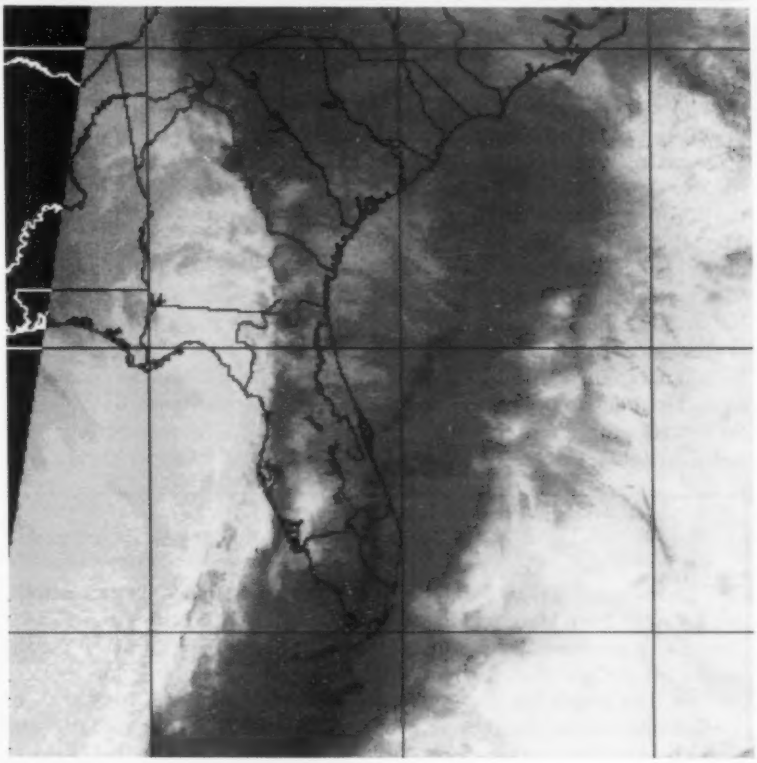
From the 10th through the 15th of March 1993 a severe winter storm struck the Gulf Coast and eastern United States with strong winds, an unprecedented late-season snowfall and bitter cold. A combination of an intense upper level situation, an intensifying storm over warmer than normal Gulf of Mexico waters, and a surge of arctic air were the ingredients that fueled this atmospheric powerhouse. Its sheer strength was attested to by the number of all-time minimum barometric pressure records that were shattered from Florida to New Hampshire. This included a 975-millibar reading at Tallahassee, FL and a 966.5-millibar pressure at Washington National Airport in Virginia. In the Carolinas the storm broke pressure records set by hurricanes, Hazel in Raleigh-Durham, NC and Hugo in Columbia, SC. Lowest all-time pressure were recorded at White Plains, NY (28.38 inches of mercury or 958.4 millibars); Philadelphia, PA and JFK Airport, NY (28.43 inches); Dover, DE (28.45 inches) and Boston, MA (28.51 inches) along with several other cities.

Blizzard conditions were reported from Alabama to Maine while more than 25 tornadoes ravaged parts of Florida. A 4-inch

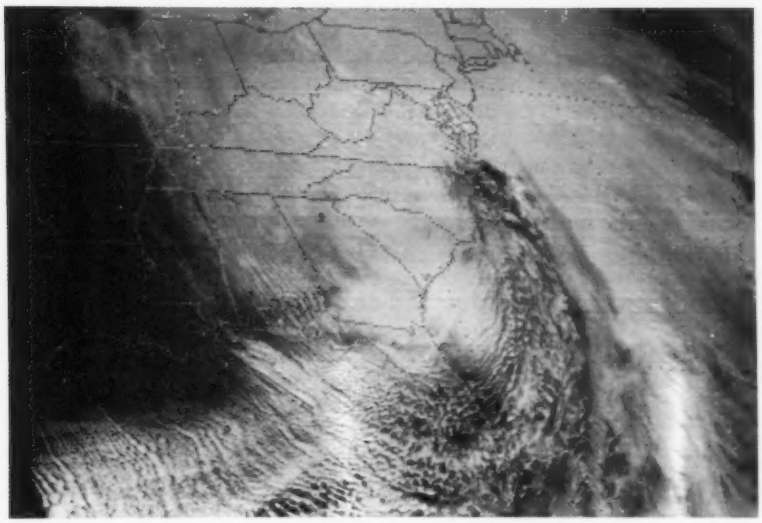
snowfall in Montgomery, AL was its greatest total since 1914. Birmingham, AL with 13 inches topped its record for an entire season while the 27 inches that fell in Albany, NY was its heaviest since the *Blizzard of 1888*. Snowfall totals also included 50 inches on Mount Mitchell, NC, 44 inches in Snowshoe, WV and 43 inches in Syracuse, NY.

A spokesman for the National Weather Service's Special Studies Branch said that the volume of water that fell as snow may be unprecedented. For example, the NWS office at the Asheville, NC air port reported a snow/water ratio of 4.2 to 1 from core samples of new snow. Due to the weight of the heavy snow, damage to trees and some buildings was extensive.

The highest recorded wind gusts were 110 mph in Franklin County, FL and 110 mph on Mount Washington, NH. Gusts of 98 mph were reported on South Timbalier, LA with a 92-mph gust on South Marsh Island, LA. Winds gusted to hurricane force all along the East Coast, and as the storm moved northward it pulled extremely cold air deep into the South.



CoastWatch



NESDIS

The GOES satellite photograph above shows a visible image taken at 1830 UTC on the 13th of March 1993. Above right is an AVHRR (Advanced Very High Resolution Radiometer) image taken on the 13th at 0902 UTC. The dark line across Florida is a squall line that produced tornadoes and extreme winds. The darker shading represents cold temperatures, which indicate higher cloud tops..

At least 18 homes fell into the sea on Long Island, in an area which had already suffered in December, and about 200 homes along North Carolina's Outer Banks were damaged. To date there were at least 243 deaths attributed to the storm and 48 people missing at sea.

At sea the Coast Guard reported that they had rescued 235 people from 103 vessels in the Gulf of Mexico alone over the weekend. Coast Guard helicopters from Miami, Clearwater, Savannah, GA,

and Mobile, AL flew around the clock. The bulk carrier ***Olympic Glow***, loaded with grain for Barcelona, ran aground just before getting out of the Mississippi River at about 1810 (LST) on the 12th, when it was estimating winds from the northwest at 60 to 80 knots. The MV ***Miss Beholden***, with a crew of five, ran aground on western Sambo Reef in the Florida Keys National Marine Sanctuary. Several Mexican ports including Tampico, Altamira, Tuxpan and Veracruz were closed due to the storm and the central and western coasts of Cuba, including Havana, were battered by the storm leaving five people dead. The 205-foot Honduran vessel MV ***Fantastico*** sank in 30-foot seas and 40-knot winds about 70 nautical miles south southwest of Fort Myers at about 2025 UTC on the 13th. Coast Guard helicopters picked up three crew members and four bodies, while four others remain missing.

The ***Gold Bond Conveyor***, with a crew of 33, left Halifax for Tampa on the 13th with a load of gypsum. On the 14th the master reported that the vessel was rolling heavily and 65-foot swells were breaking over the upper decks. A final call came just after midnight when the captain sent a distress call and reported the crew was abandoning ship. The vessel sank about 110 nautical miles southeast of Cape Sable Island. Rescue efforts were hampered by heavy snow. One body was eventually recovered along with two empty liferafts. The other 32 were listed as missing. In other incidents at sea the container vessel ***Alaska*** reported 26 containers washed overboard on the 12th near 33.9°N, 72.5°W, while the ro ro vessel ***Colon*** reported losing nine containers on the 12th near 25.5°N, 92.8°W.

SS *Tropic Sun* Encounters Blizzard of March 1993

The steam tanker ***Tropic Sun*** recently had the misfortune of experiencing *The Storm of the Century* as it was making a voyage from Marcus Hook, Pennsylvania to Nederland, Texas. The barogram (right) depicts the dramatic barometric pressure changes that occurred as the ship encountered the storm along the East Coast and in particular off of Cape Hatteras. An account of their encounter follows below.

The ***Tropic Sun*** took departure at Delaware Capes at 1918 EST on the 12th of March. She was partially loaded with various liquid petroleum products. Within 3 hours of departure, the wind steadily increased to Force 6 out of the east southeast and the barometric pressure had begun to fall. By 0500 EST on the 13th, the wind had reached Force 8 and the pressure was dropping steadily at about 5 millibars per hour. By 1000 EST the wind was at Force 10 out of the southeast and things were getting "interesting!"

Between 1000 and 1100 EST there was a significant improvement in the weather conditions. The wind and seas diminished greatly, to the extent that the ship could increase to near full sea speed. This marked change in weather can be seen on the barogram. We are of the opinion that we had found a secondary "eye of the storm" as weather reports had the storm center located well inland over the Carolinas.

The better weather was very short-lived! The barometric pressure began to plunge once again, the wind rapidly picked up the pace and the seas resumed building. The barometer bottomed out at 974 millibars between 1400 and 1600 (on the 13th). By 1700 EST the wind had reached hurricane force and until about 2300 EST it was sustained at about 60 knots with gusts to 90 knots or higher. Very heavy wind-driven rain and a brief period of sleet prevailed throughout this period.

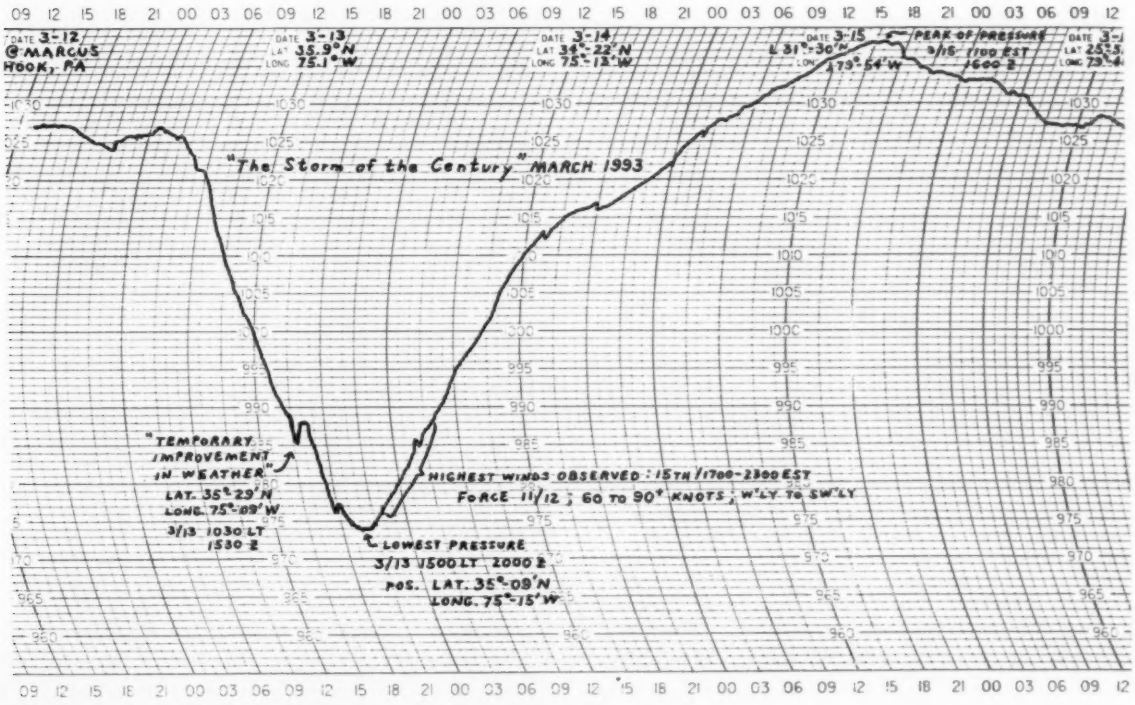
The wind and accompanying seas were described by the Mates in the logbook as "exceptionally high," "relentless," "violent," and even "mountainous!" The vessel's speed had been reduced to bare steerageway in seas that were at least 60 feet high. The helmsmen, steering by hand, were experiencing great difficulty in keeping the ship on course. The ship was located off of Cape Hatteras; with prevailing conditions and the intersection of the Gulf Stream, she was making little if any forward progress. Visibility was greatly reduced in the heavy precipitation and blowing spray.

Throughout the night into the 14th, the wind remained at or near hurricane force and the seas were violent and huge. Very gradually the wind began to decrease in velocity and the seas to diminish. Meanwhile the barometric pressure was rising nearly as quickly as it had fallen, reaching a peak of 1038 millibars between 1000 and 1200 EST on the 15th. By this time the entire crew was very relieved that the wind was "only" blowing at Force 6 to 7!

The ***Tropic Sun*** reached Texas safely on the 18th with minimal damage. This was an experience that will definitely always be remembered by her crew. The monster storm had earned the title "Storm of the Century," though some of those aboard liked to refer to her as "The Mother of all Storms!"

The 147-foot freighter **Miss Beholden** *was bound for Mexico with a cargo of cigarettes and candy when it ran hard aground on the 13th southeast of Key West (left). The grounding occurred in a shallow reef area that is part of the Florida Keys National Marine Sanctuary. A team of NOAA divers and a NOAA biologist went to the site to determine the extent of the damage to both the ship and the coral. The vessel was eventually removed from the reef.*

The *Tropic Sun* *was enroute from Marcus Hook, PA to Nederland, TX. See the story to the left. Their barograph trace can be found below. The sudden rise in pressure followed by a slight but temporary improvement in the weather was most likely the result of a squall line ahead of the main storm. This little pressure jag is noticeable in most of the accompanying barograph traces.*

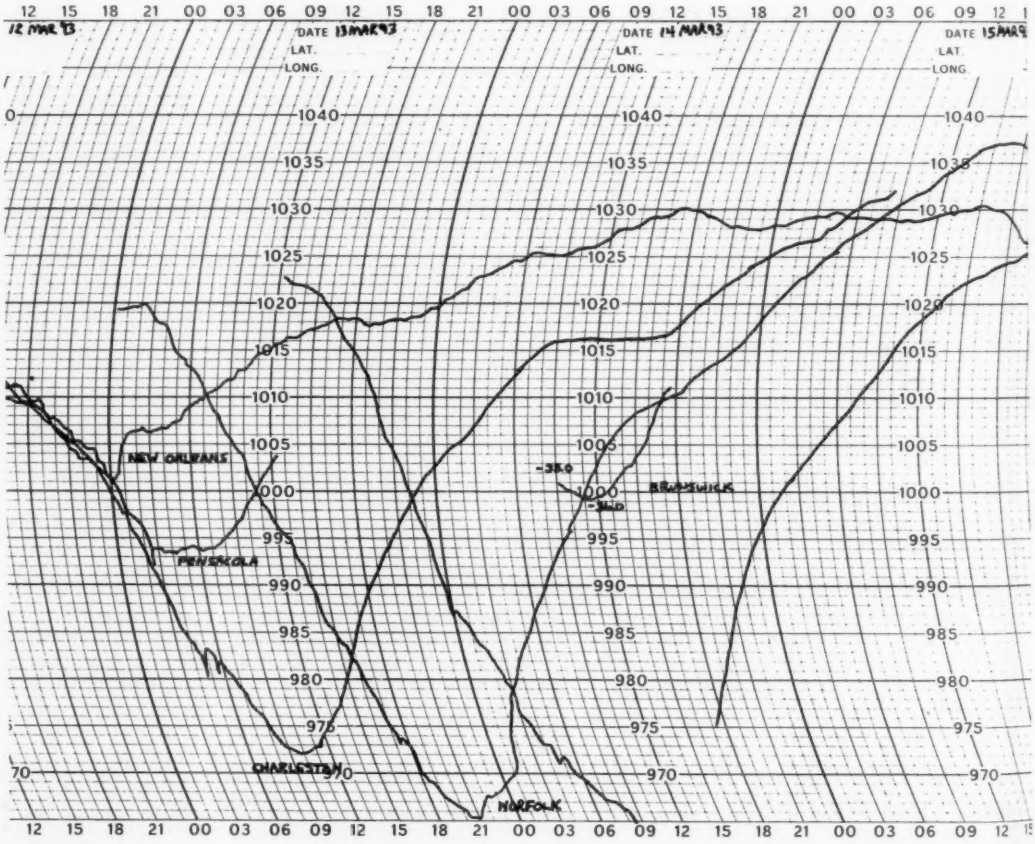


A Coast Guard View of the Storm

AG1 Gordon McCraw

While the explosive cyclogenesis (extratropical low pressure system where pressure falls at least 24 millibars in 24 hours) is common over oceanic regions, the coastal winter storm of March 12–15, 1993 can easily be categorized as one in a hundred year weather phenomena. As noted from the transposed microbarograph tracings from a number of Naval Air Stations along the Gulf of Mexico and the Eastern Seaboard, the extremely low pressures that were experienced made this storm one to remember.

Beside the bitter cold and heavy snowfall, which shattered records along its path, extremely high winds were also common. For nearly 48 hours stations experienced sustained winds of 25 to 40 knots with gusts to 60 knots while hurricane force winds caught many offshore by surprise. The Eighth Coast Guard District, headquartered in New Orleans, covers the Gulf Coast from Apalachicola Bay in Florida to the U.S.–Mexico border near Brownsville, reported 111 storm Search and Rescue cases. This involved 64 vessels and 2 aircraft in distress. During the period of March 12–15, the Coast Guard flew 99 aircraft sorties with 61 vessel sorties which saved 33 lives.

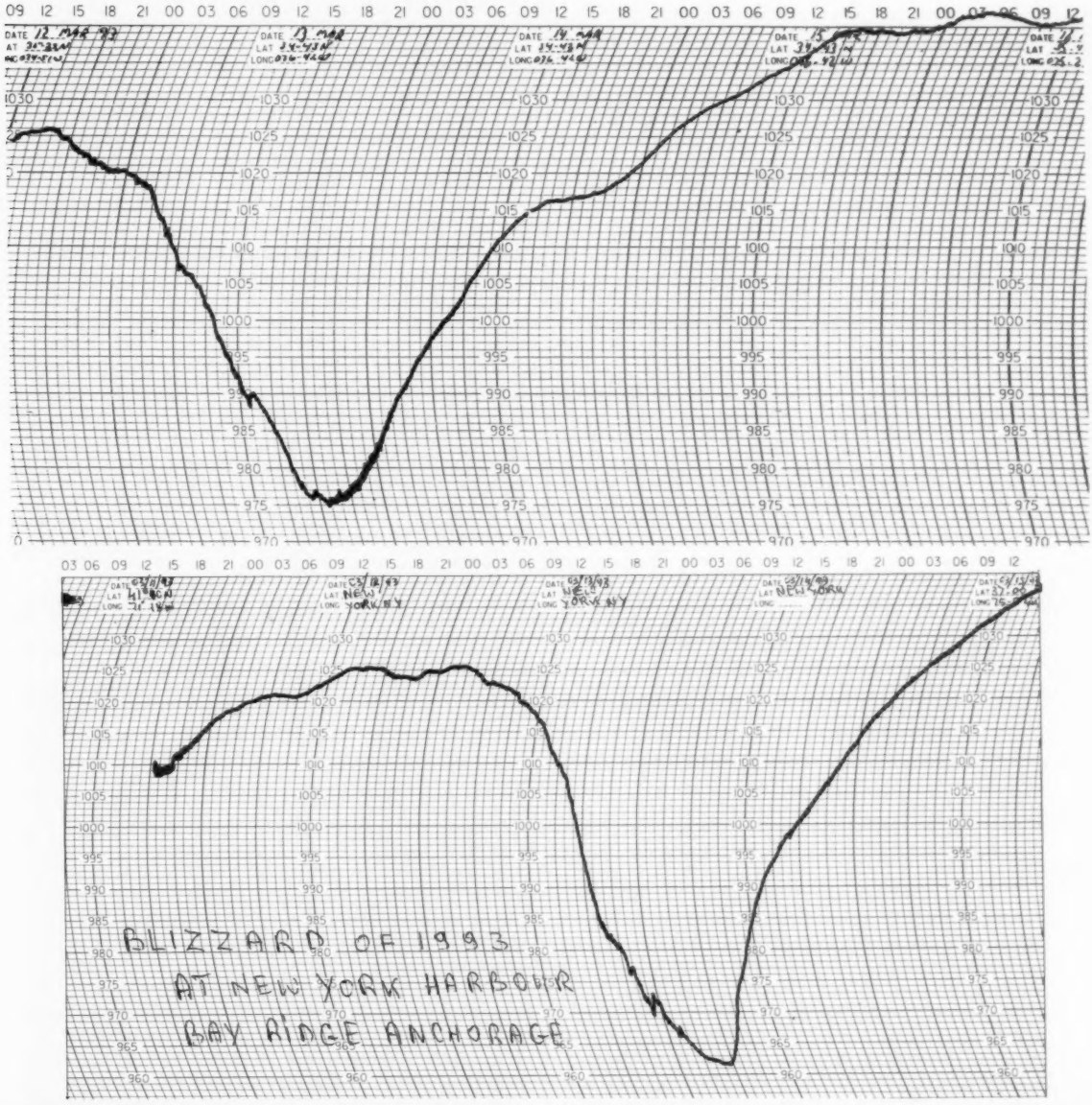


At right is a composite view of several microbarograph tracings from Naval Air Stations along the Gulf and East Coasts. They were transposed onto a single chart for comparison purposes. The trace at Brunswick, ME was moved up or reset as to 1000 millibars as the pressure approached the 965 millibar bottom line, so actually the 1000 mb line in that case represents the 965 millibar line and Brunswick's lowest pressure was therefore 964 millibars. The map in the upper right is a brief summary of the lowest pressures given in inches of mercury.

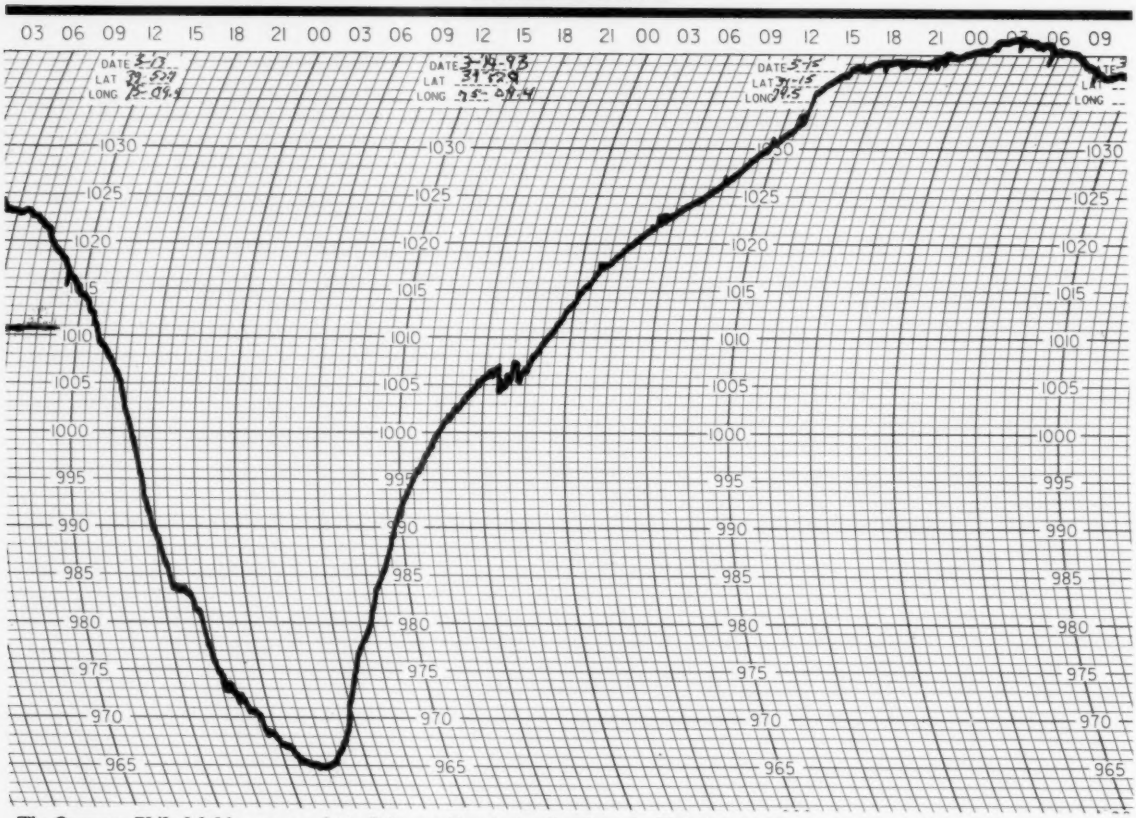
Barogram Heaven

We were working off Cape Hatteras, NC when the storm began to intensify. Fortunately, we were able to get into Morehead City, NC before winds increased considerably. When we entered port on Saturday (13th), the barometer was about 1008 millibars (0600LST) and falling (below). We had sustained winds from the south southeast at 35 knots gusting to 50 knots. While in port the storm passed, bottoming out at 975 mb. As the barometer rose so did the wind. Beaufort, NC had recorded winds of 84 knots and at the ship in Morehead we logged winds as high as 75 knots. It is interesting to note the difference between the low pressure of the storm and the high pressure behind it (1042 millibars).

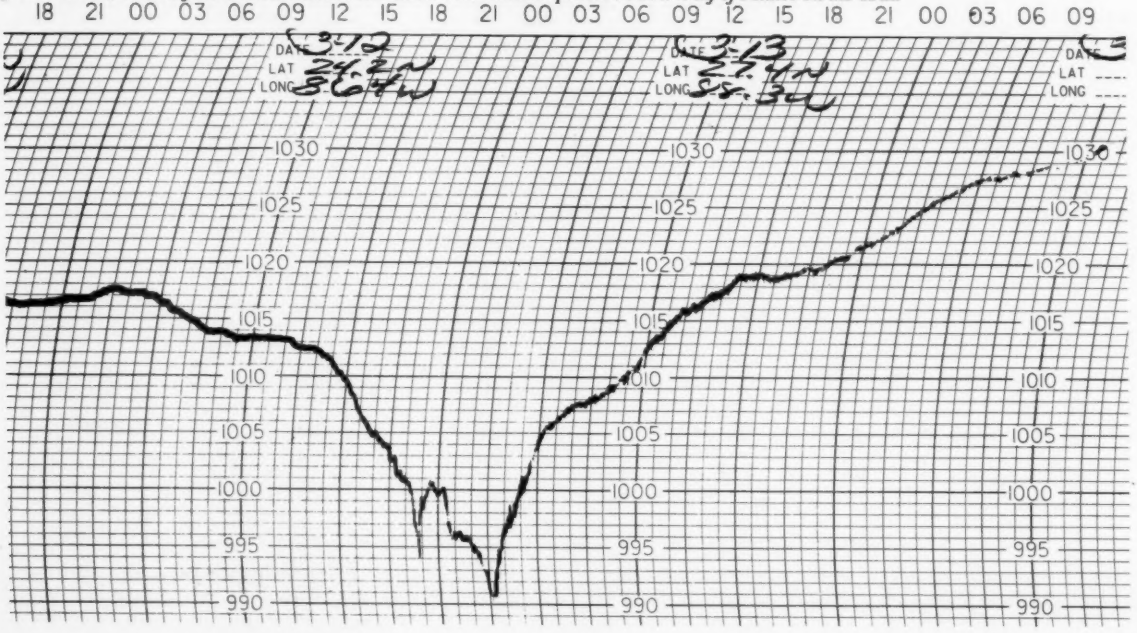
Pete Celone
Executive Officer, ***Albatross IV***

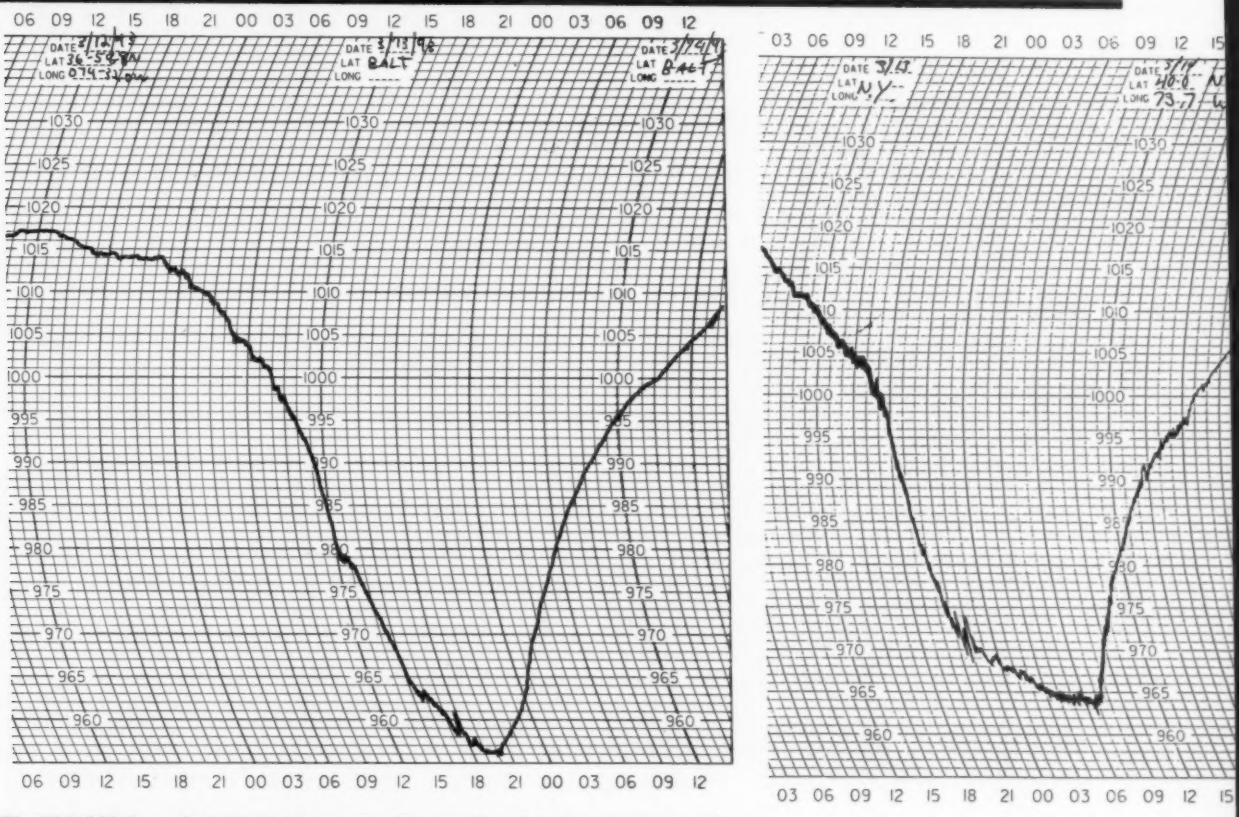


The ***OMI Wabash*** *was enroute from Pt. Judith to the Gulf of Mexico and ended up seeking shelter in New York Harbor during the Blizzard of March 1993. They anchored at Bay Ridge. Their low reading was about 961.5 millibars.*

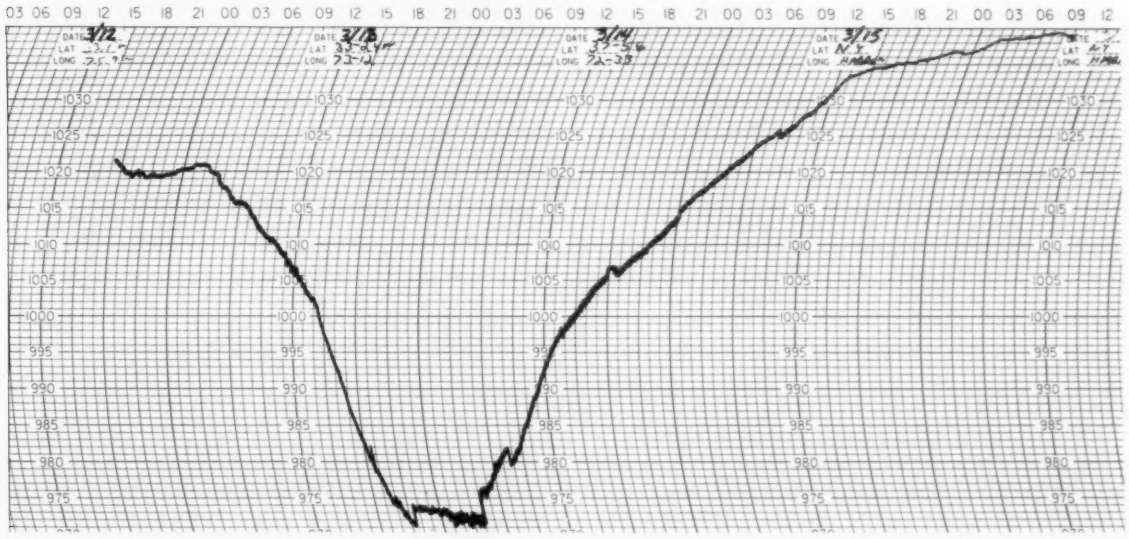


The ***Overseas Philadelphia*** *was caught in Delaware Bay during the blizzard. Their barograph trace is shown above. Below, the* ***Inger*** *from Durban, South Africa to New Orleans recorded a 991-millibar pressure in the Gulf of Mexico on the 13th.*





*The **Global Link** was docked in Baltimore when the storm blew through and came up with a 956-millibar reading at about 2000 on the 13th (above). Below, the **Exxon Charleston** was traveling from Galveston to New York when it ran into the storm off Cape Hatteras. The **Raleigh Bay** (right) was holed up in New York on its way to Rotterdam and measured about a 962-millibar pressure.*



We Want Your Video!

The National Weather Service is making a training video for taking weather observations at sea. We need scenes of waves, fog, clouds, ice, rough weather, optical phenomena and other weather elements. The original video can be returned to you. As usual, we depend upon our voluntary observers to make our product a success. Send us your best shot.

Please Send to:

Vince Zegowitz Productions
National Weather Service, NOAA
Room 17345
1325 East West Highway
Silver Spring, MD 20910

Jerry Bielicki

Channel Islands National Marine Sanctuary

Justin Kenney

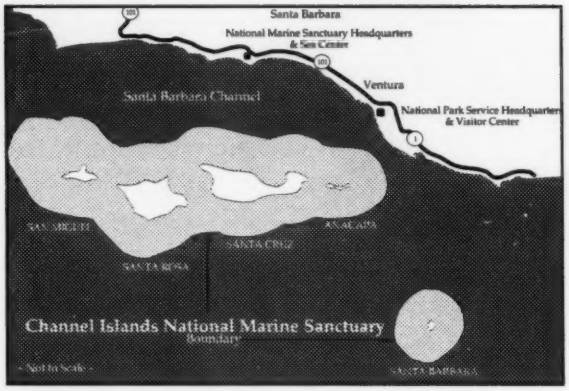
Michael K. Ward

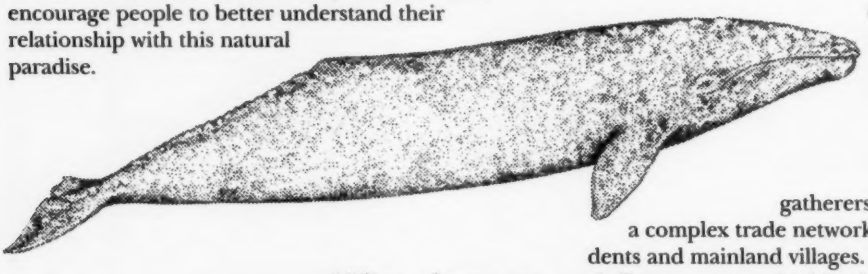
Great spirit, I come to you in thanksgiving and humility
Accept this offering from one who travels your waters and hunts your creatures
Help me use your gifts wisely and protect them for my people

—Lt. Commander Stephen C. Jameson
Former Sanctuary Manager

Each December, residents of Santa Barbara prepare for the arrival of visitors from the North; not camera-wielding, sunworshipers from the Midwest, but the majestic gray whales migrating from the Bering Sea to the Baja Peninsula. The gray whales have long known what we only recently have begun to appreciate: the waters off southern California's Channel Islands are exceptional in the abundance they contain.

After a devastating oil spill in 1969, Santa Barbara residents struggled for 11 years to get federal protection for the many creatures that live among the kelp forests around the Channel Islands. In 1980, NOAA designated the waters surrounding San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands–1,252 square nautical miles in all–as the nation's third marine sanctuary. Because the sanctuary includes near-shore waters, private and public entities from the National Park Service to The Nature Conservancy are involved. NOAA quickly realized that protecting the marine resources should not, and could not, be done alone. Since 1980, a partnership between local residents, private enterprise, and all levels of government has created innovative educational programs, promoted research, and fostered community involvement to encourage people to better understand their relationship with this natural paradise.





Millions of years ago, volcanic activity along the Earth's shifting plates created the Santa Ynez Mountains along the California coast and the submerged mountains offshore. The rise and fall of the sea level carved deep submarine canyons at the base of these mountains. Today, their exposed tips form the Channel Islands: the northern cluster of San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands; and San Nicolas, Santa Barbara, Santa Catalina, and San Clemente Islands to the south. A diverse and special world evolved on the islands and in the surrounding waters.

The ancestors of the Chumash Indians arrived at the Channel Islands some 9,000 years ago and established a society dependent on marine resources. Primarily fishermen, hunters, and gatherers, the Chumash developed a complex trade network between the island residents and mainland villages. Using beads made from shells as currency, the island Chumash bartered for food and supplies. This trade between the island and mainland people made for an enviable standard of life.

For the island dwellers, trading for goods required an efficient means to make the trip to shore. They found the answer in the huge redwood logs that drifted to the islands from the North. The Chumash used the driftwood to build a canoe-like vessel called a *tomol*. Unlike the canoe, which was usually dug out of a single tree, the Chumash built the *tomol* with boards. First, they shaped the boards with stone tools, then sewed them together with fibers, and caulked the joints with a coating of tar. The *tomol*, decorated with red ochre and shells, provided a sturdy and effective means of transporting goods. They were typically 25 to 30 feet long and were often used to cross the Santa Barbara Channel, and trips were made as far south as Santa Catalina and San Clemente Islands. Such crossings were often made at night or during the early morning hours when seas are calm.

Mariners Weather Log

Channel Islands is the third in a series of articles on U.S. marine sanctuaries. Channel Island's story emphasizes the importance of protecting the life that flourishes on and in the seas around these islands.

Special thanks to the staffs at the Channel Islands National Marine Sancturay and the Santa Barbara Museum of Natural History for their assistance with this article. For additional information on Channel Islands National Marine Sanctuary, please write to:

Channel Islands National Marine Sanctuary
113 Harbor Way
Santa Barbara, CA 93109

For the Bicentennial, the Santa Barbara Museum of Natural History decided to build a tomol. The typical tomol is 25 to 30 feet long, built from redwood, then coated with ochre and decorated with abalone shells. The one on display at the museum is approximately 28 feet long. This 20th century version is made from milled driftwood, sewn together with nylon and glued with epoxy. Rowed by three people it can move along at 7 knots if wind and swell are right. It can carry up to 2,000 pounds of passengers and cargo and is very stable with ballast. Photograph at left was taken by professional photographer Peter C. Howorth of Santa Barbara.

The scene on the cover page is entitled "Tomol at Twin Harbor, (Orizaba), Santa Cruz Island, California." Note the Chumash thatched houses and shrine in the village in the background. This is a black and white copy of an original oil painting by Michael Ward.

Some 4,000 Chumash descendants still live in the Santa Barbara and Ventura areas, and clues left behind on land and offshore continue to tell the Chumash's story. A NOAA team included a Chumash observer with its archaeologist and maritime historian to gather information about the early inhabitants of Santa Cruz Island. The team combined land-based archaeological knowledge with new sonar technology (rapid FM frequency sound bursts called "chirps") to locate drowned stream beds exposed during the lower sea levels of the last Ice Age. Analysis of the samples may show how the early civilizations used the marine resources and help us learn from their successes and failures in protecting the resources.

Historians credit Juan Rodriguez Cabrillo as the first European to navigate the Santa Barbara Channel in 1542 followed by Sebastian Vizcaíno who was sent by Spain to chart the California coast. Vizcaíno's charts gave Santa Barbara and several of the other islands their present names. Despite these early contacts, Chumash culture continued to thrive in the Santa Barbara Channel region. Ultimately, the introduction of the mission system of the Spaniards and Mexicans led to the breakdown of Chumash culture.

By the time California was made a state in 1850, Santa Barbara had served as a fishing and whaling station and a port for the hide and tallow trade. By the late 1800s, California was exporting wheat to

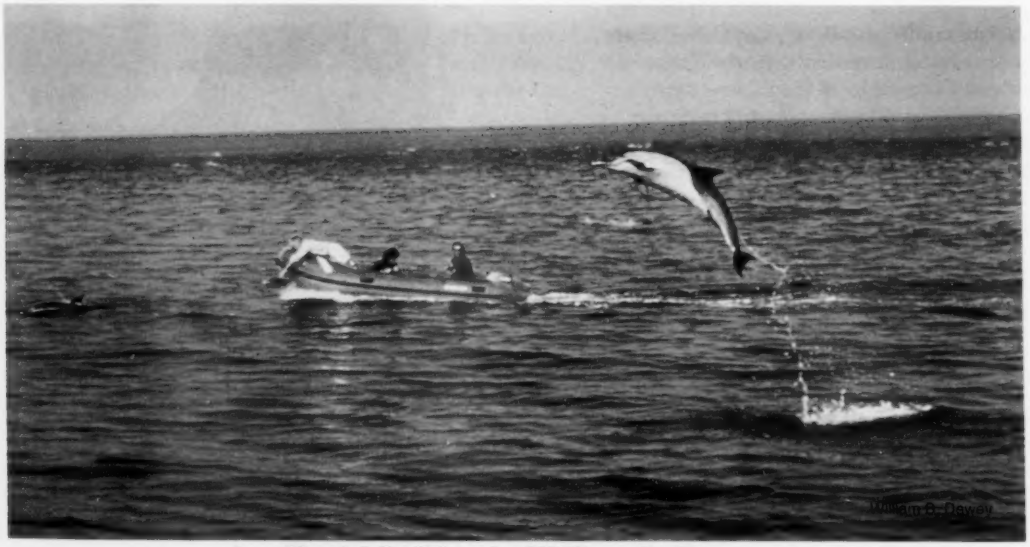
The Marriage of Luhui

The name Luhui appears throughout Chumash history and is a common name today in the Santa Cruz area. In one traditional story, she is Princess of all the Channel Islands. In another Luhui lives during California's mission period when Chumash culture was in decline and its people were dying from European diseases. With the remnants of her people, she is taken by Spanish invaders to the mainland and rechristened Encarnacion. The artist Michael K. Ward's "Marriage of Luhui" creates a representation of the wedding day of Princess Luhui. This sketch is the result of Ward's lifelong studies of the Chumash culture. The decorations his Princess wears are a historically accurate image of the patterns and body decorations used in traditional times.

Channel Island's

Basking Shark by Chris Gotschalk

Channel Islands

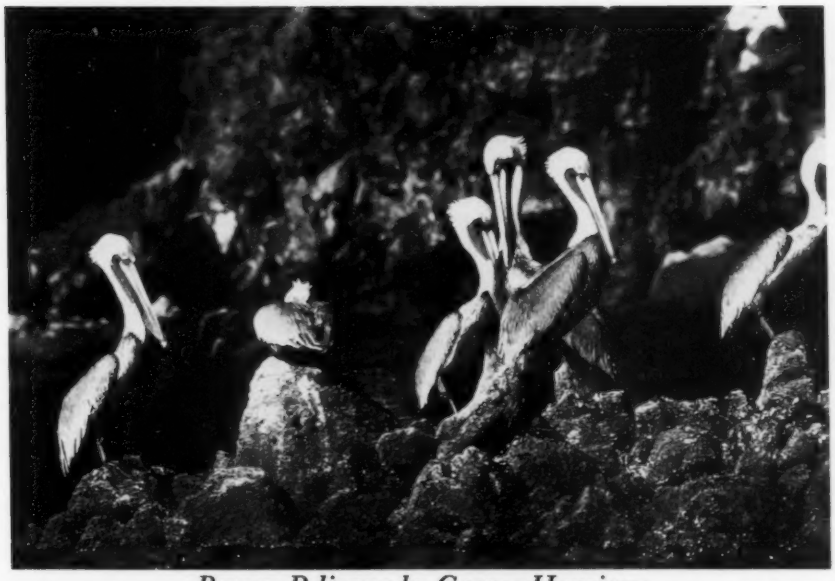


Playful Dolphin by William B. Dewey

Indelible Images

by Dean DePhillipo

Seal Pup by Cecil W. Stoughton



Brown Pelicans by George Harrison

foreign ports. One member of the "wheat fleet" still remains below the Channel waters and has recently been nominated to the National Register of Historic Places. In 1892, a four-masted British built clipper known as the ***Goldenhorn*** sailed into a submerged reef in 11 feet of water. The 28 crew members escaped, but the broken hull of the ship still lies scattered near Santa Rosa Island reef 100 years later. While some portions are buried under heavy sand, divers discovered the wreck in the 1960s and were able to recover artifacts– a large brass nameplate and a brass cap of the capstan engraved ***Goldenhorn*** among them.

Two later discoveries forever changed the economy of Santa Barbara. A 19th century British chemist, E.C.C. Stanford, discovered that algin extracted from kelp could be used as an emulsifier in beer, ice cream, toothpaste, paint, and many other products. Today large combine-like machines slice through the seaweed, transferring the harvest into waiting ships.

The second significant discovery was oil. By the early 1900s, oil companies had begun offshore drilling, and in the 1950s they had their first genuine offshore platform in the Channel Islands. For the next several decades oil and gas exploration, now banned within sanctuary boundaries, would thrive in the region.

And with oil came the possibility of marine disaster. Environmentalists and local residents are still wary of the big terminals. They worry that Santa Barbara's ability to respond to a marine emergency, an oil spill, or a fire emergency may well be inadequate. Other dangers also exist.

Santa Barbara Channel has become an ocean freeway for tankers, large commercial ships, and fishing vessels. A recent article entitled "Tankers Away!" detailed the problem.

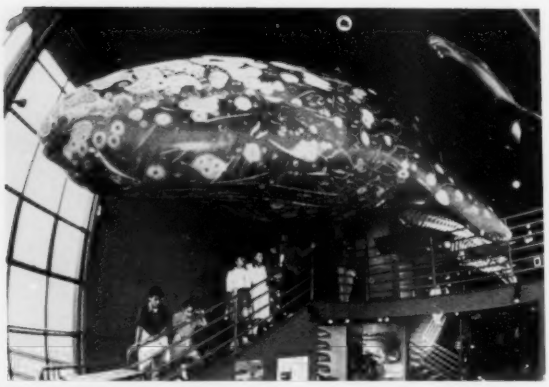
"At the east end of the channel, the big ships must squeeze through the 11-mile gap between Port Hueneme and the three Anacapa islets. Nine American destroyers were lost on the rocks off Point Conception within 10 minutes back in 1923 swept by fierce northwest winds, high seas, dense fog and rocky coast. Oil carriers are bigger and faster than ever. Together with the dry cargo vessels, they come through at the rate of at least one per hour. Daily traffic in the area may include tankers, dry cargo vessels having to avoid other tankers, freighters, small boats, oil drilling rigs, and production platforms through a 65-mile channel. The Coast Guard say it's safer to keep the tankers inside the channel. Banning them would route tankers to less weather-protected waters without vessel lanes and into the Navy's Pacific Missile Range."

Throughout the modern history of the Channel Islands, the local economy has been tied directly to the marine resources. The Chumash learned the need for a balance to ensure the survival of both the resources and economy. The devastation of the Northern fur seal and elephant seal populations near the turn of the century is evidence that we have yet to find the balance between resources and the economy.

Since these species would routinely return to the same rookeries to breed, the seals were easy targets for fur hunters. Eventually, hunting completely wiped the fur seal off San Miguel Island, and by 1938, only 13 elephant seals existed in the world. With protection provided by international treaty and the sanctuary, both populations continue to recover.

Unfortunately, a similar story seems to be playing out for the commercially important abalone. Over-harvesting, aggravated by a mysterious die-off called withering syndrome, have all but eliminated the abalone. Scientists are conducting three major studies in sanctuary waters to determine the cause of this fatal die-off and hopefully will restore the abalone to its original population.

The weather too can affect the delicate ecosystem of the Channel Islands. The recent *El Niño* caused the death of an unusually large number of seals, sea lions, pelicans, and other marine life. *El Niño* dramatically reduced sea bird nesting and the number and size of seal and sea lion pups was much smaller than normal. However, it produced a banner year for whale watching in the sanctuary. With the population explosion of krill, small shrimp-like crustaceans, an unprecedented number of whales came to feed. Mild winds moved warm surface water away and caused nutrient rich deep water to upwell and reinvigorate the food chain. The challenge for the sanctuary and the community partnership is to find the balance between



The Sea Center (above) is a joint venture between the Santa Barbara Museum of Natural History and the Channel Islands National Marine Sanctuary.

The Los Marineros program gives local schoolchildren a chance aboard research vessels to help collect oceanographic and biological samples with the help of volunteers from both the National Marine Sanctuary program and the Santa Barbara Museum of Natural History. These children are often from neighborhoods where they would not otherwise get this type of opportunity and the program could, hopefully, make an important difference in their attitude toward education.

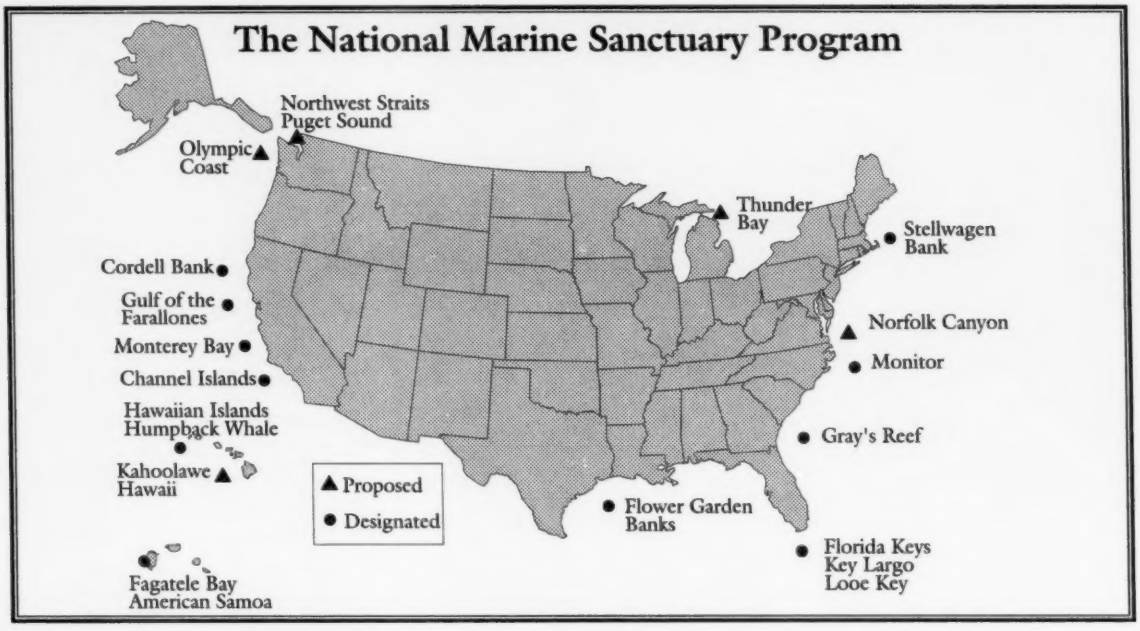
resource protection and continued commercial uses. One group works to promote this balance. Called *Los Marineros* by the locals, they are members of an innovative science program to teach local schoolchildren about the marine environment through direct interaction. A group of volunteers from the sanctuary and the Santa Barbara Museum of Natural History began the project in 1987 with one school. Today, *Los Marineros* includes 20 classes and 550 students at 6 elementary schools. The idea was to get students out of the classroom and aboard research vessels and whale watching ships to experience and learn first hand. For many children, *Los Marineros* was their first chance to be on a boat although they may live only a few blocks from the water. The experience and knowledge that both the students and the teachers take with them are one of the best investments in resource protection that the sanctuary can make. Members of Project Ocean Search, Pam Stacey and Dr. Richard C. Murphy, have written that only by personal experience will there come a deeper understanding of nature and an increased desire to preserve it. The images of life in the Channel Islands Sanctuary that these children will take with them are indelible.

On the western most San Miguel Island, Steller and California sea lions bask in the warm sun while 3-ton male elephant seals vie for mating rights by hurling their massive bodies against each other. The combination of uninhabited islands and a rich supply of food attracts more than 60 species of sea birds, including the California brown pelican. This endangered bird colonizes on Anacapa Island and a lucky visitor may spy one of these graceful flyers cruising the open waters and diving suddenly in search of a meal. At varying times in the year, over 25 species of whales, dolphins, and porpoises gallivant around the islands. The gray whales navigate through the Channel along their 10,000-mile migration, pausing to feed on the tiny crustaceans living in the kelp.

As beautiful as the Channel Islands appear from above, recreational divers can attest to the wonderful scenes below the surface. Submerged forests of giant kelp surround each of the islands and grow to lengths of over 200 feet. Just as the tropical rain forest provides habitat for a variety of species, the kelp forest houses its share of interesting tenants. Sea lions play among the kelp's thick canopy. Friendly, brightly colored Garibaldi fish swim among the strands. Lobsters, urchins, and sea stars collect at the bottom near the kelp's holdfast—appropriately named for the function it performs.

Recent reports of increasing populations of elephant seals and the decision to remove the gray whale from the endangered species list offer encouraging news. But the goal of resource protection is a continuing one. For each success, new challenges face the communities along the Santa Barbara Channel. As the partnership that has evolved to protect the resources of the Channel Islands continues to seek new, innovative solutions, it should be guided by the simple Native American plea stated in the poem by Stephen Jameson:

"Help me use your gifts wisely and protect them for my people."



Our nation's marine waters support an incredible diversity of life—the lush kelp forests off the coast of California, the limestone outcroppings of Georgia's Gray's Reef, the tropical coral reef within an ancient submerged volcano of American Samoa, and the colorful coral reefs of the Florida Keys. The mystery and beauty of these delicate ecosystems inspire scientist and poet alike to understand and appreciate their marine treasures. These waters also hold the secrets of our nation's past. Sunken civilizations, naval and commercial vessels, and countless artifacts lie silently waiting for their stories to be told.

In recognition of the special ecological, historical, recreational, and aesthetic values of our marine waters, the National Marine Sanctuary Program was established in 1972 to provide long–term protection and management. Under the direction of the National Oceanic and Atmospheric Administration, 13 marine sanctuaries have been designated, each unique in the natural and cultural resources it contains. Part of the collective riches of our nation, the sanctuaries belong to all of us to enjoy, to learn from, and most important to protect for future generations.

Channel Islands NMS
113 Harbor Way
Santa Barbara, CA 93109
(805) 966-7107

Gulf of the Farallones NMS
Fort Mason, Building #201
San Francisco, CA 94123
(415) 556-3509

Cordell Bank NMS
Fort Mason, Building #201
San Francisco, CA 94123
(415) 556-3509

Fagatele Bay NMS
P.O. Box 4318
Pago Pago, AS 96799
(684) 633-5155

Florida Keys NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Gray's Reef NMS
P.O. Box 13687
Savannah, GA 31416
(912) 356-2496

Monitor NMS, NOAA
Building 1519
Fort Eustis, VA 23604
(804) 878-3511

Looe Key NMS
Route 1, Box 782
Big Pine Key, FL 33043
(305) 872-4039

Key Largo NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Flower Garden Banks NMS
1716 Briarcrest Drive, Suite 702
Bryan, TX 77802
(409) 847-9296

Monterey Bay NMS
2560 Garden Rd. #101
Monterey, CA 93940
(408) 647–4225

Hawaiian Islands
Humpback Whale
Stellwagen Bank
SSMC4, 12th Floor
1305 East–West Highway
Silver Spring, MD 20910
(202) 606-4126

This discarded line is done fishing. But it's not done killing.

Carelessly discarded plastic fishing line can keep working long after you're done with it – entangling birds, seals, sea turtles, and other animals.

And because plastic line is strong and durable, it's nearly impossible for these animals to break free. They strangle, drown, or starve. That's not sporting.

Some birds even use old fishing line in their nests, creating death traps for their young.

Other plastic debris can be dangerous, too. Fish, birds, and seals become entangled in six-pack rings. Sea turtles eat plastic bags – which they mistake for jellyfish – and suffer internal injury, intestinal blockage, or death by starvation. Birds are known to ingest everything from small plastic pieces to plastic cigarette lighters and bottle caps.

Plastic debris also can foul boat propellers and block cooling intakes, causing annoying – sometimes dangerous – delays and causing costly repairs.

So please, save your old fishing line and other plastic trash for proper disposal.

That's not all you'll be saving.

To learn more about how you can help, write: Center for Marine Conservation, 1725 DeSales Street, N.W., Suite 500, Washington, D.C. 20036.

A public service message from:
The Center for Marine Conservation
The National Oceanic and Atmospheric Administration
The Society of the Plastics Industry

Weather Reports and VOS News

Martin S. Baron
National Weather Service

During the 3-month period, January through March 31, 1993, PMOs recruited 64 vessels as weather observers/reporters in the NWS VOS Program. We thank ships for joining the program.

Observations from moving ships form the basis of marine data acquisition programs worldwide. These data are necessary to prepare weather forecasts for marine areas. Data from the southern hemisphere are in particularly short supply, especially from the South Atlantic, Indian, and South Pacific Oceans. There is also a shortage of observations from the Arctic Ocean. From the North Atlantic and North Pacific Oceans, more observations are needed at 0600 and 1200 UTC. These are your late night/early morning reports, and we hope ships will make every effort to transmit them. More data are also needed from coastal waters, especially off the U.S. and Canadian west coasts, and from the Caribbean Sea. During the northern hemisphere hurricane season (May - November), reports from the tropics and the easterly trade wind belt (roughly 5°–35°N) are especially important.

Some misinformation still persists about the importance of reports close to the coast. These reports are extremely valuable, not only for the marine forecaster, but also for weather forecasts prepared for land areas near shore. Weather in the coastal zone can be very changeable and often moves inland. The forecaster needs all the information available. There is a 3-hourly reporting schedule in all United States and Canadian coastal waters out 200 miles. Please comply with this schedule, time permitting.

When taking and recording observations, accuracy is of paramount importance. An inaccurate observation can mislead the forecaster, and result in a poor forecast. A reliable observation can hold the key to a complex meteorological situation. Accuracy is also important for research purposes. For example, the World Climate Research program requires very precise temperature data (air and sea-surface), accurate to the nearest .1° centigrade. Data from the trade wind belt (roughly 5°–35° N) are especially important.

We also thank officers for their fine work, dedication and commitment. Without your participation in the VOS program, there would be vast marine areas without data, making weather forecasting nearly impossible.

Port Meteorological Officer Workshop A Huge Success

The Voluntary Observing Ship (VOS) Program/Port Meteorological Officer (PMO) workshop was held March 2-4, 1993, in Jacksonville Florida. It was attended by PMOs, Program Managers and specialists from National Weather Service (NWS) Headquarters, NWS regional offices, National Ocean

The Port Meteorological Officer's Conference 1993–Jacksonville, FL. From left to right: Ron Fordyce (AES, Canada), Jack Warrelmann (PMO, New Orleans), Martin Bonk (PMO, Newark), Jim Saunders (PMO, Baltimore) Dave Feit (NMC, NWS) Gerald Cathey (Central Region, NWS) Charles Henson (PMO, Miami), Ray Brown (PMO, Norfolk), Cliff Crowley (Eastern Region, NWS), Tom Hunter (DMA), Jim Nelson (PMO, Houston aka NOAA's ham), Wilbur Biggs (NCDC), Doug Davis (Southern Region, NWS), Vince Zegowitz (Marine Obs. Program Leader, NWS), Dave Bakeman (PMO, Seattle), Andy Brewington (Alaska, NWS), Dave Lamb (Western Region, NWS), Bob Webster (PMO Hollywood er Long Beach), George Smith (PMO, Cleveland), Larry Cain (host and PMO Jacksonville), Marty Baron (VOS Program Manager, NWS), James Schroeder (Central Region, NWS), Bob Collins (PMO, Chicago), Doug Hess (Headquarters, NWS), Ken Haydu (NHC, NWS), Ed Gumkowski (International Telecommunications, NWS), Valery Thompson (Lead Forecaster, NWS), Bob Novak (PMO, Oakland, and raconteur).

Survey, National Climatic Data Center, NOAA Corps, and by forecasters from the National Meteorological Center, the National Hurricane Center, and the Weather Service Forecast Office in Washington, D.C. A representative Canadian PMO and the editor of the *Mariners Weather Log* (MWL) were also present. Thirty-three people in all attended.

We have never had such a complete assembly of VOS program experts, specialists, and marine forecasters under one roof. Presentations, discussions, and dialogue were diverse and included international and World Meteorological Organization affairs, national priorities, issues, and objectives, forecaster data requirements, local and regional program requirements/affairs, and the details and particulars of program operations. It was a highly informative and educational experience for all participants. We expect many program improvements to result from the meeting.

Five Reminders For Weather Observing, Coding, and Reporting

1) **Present/Past Weather**: When reporting present weather (ww) and past weather (W_1W_2), the form and intensity of meteors in the atmosphere or formed on ship

Ms. Julie Fletcher Marine Meteorological Officer for the Meteorological Service of New Zealand, Ltd. is presented a Certificate of Appreciation for her excellent support of the U.S./NOAA Voluntary Observing Ship Program. In addition to her work with the VOS program, Julie has been interviewed in the Log and has helped us obtain information for several articles over the years. This is a well-deserved award. The distinguished looking gentleman presenting the award is none other than Steve Cook from NOS and the SEAS program. It's amazing what photography can do these days.

(rime ice and freezing rain form on ships). When no meteors have been present, report any cloud cover or development (code 00-03 for ww; 0-2 for W_1W_2. Meteors are of three types (1) hydrometeors (aqueous particles such as hail, rain, snow, freezing rain, drizzle, (2) lithometeors (non-aqueous particles such as dust, sand, haze, smoke, and (3) electrometeors (lightning, thunder). The weather data indicator i_x in group $i_R i_x hVV$ is coded as 1 when significant weather is reported; when there is no significant present or past weather to report, 1_x is coded as 2 and the entire weather group $7wwW_1W_2$ is omitted from the weather message.

2) **Wind Direction/Speed**: When using the state of the sea and Beaufort scale to estimate wind speed, remember that rain, surface and tidal currents will damp down the sea waves. Thus, under rainy conditions, or when in the vicinity of a current, your wind speed may actually be a little higher than that indicated from the sea state. Wind direction is always perpendicular to the crest line of sea waves. Take a mean reading over a 10-minute period when using a masthead anemometer, and use a wind plotting board to determine true wind direction and speed (this is not needed when using the state of the sea method).

3) **Sea/Swell**: Don't confuse sea with swell. This is most likely when the local wind direction happens to be with the incoming swell. The swell will always have a longer period than the sea, and will be more regular and uniform.

4) **INMARSAT Reports**: Complete the transmission of your INMARSAT weather report in 30 seconds or less. This helps reduce communications costs paid by the NWS. Always end the INMARSAT message with 5 periods to disconnect.

5) **Code section 0**: Always include the first 5 code groups in your weather message. They are a mandatory part of every report. Any omissions or mistakes here can result in the report being thrown out by the computers. All code figures in this section must be filled in as seen at the bottom of the page.

Please review the past five Marine Observations Program columns in this publication or NWS Observing Handbook No. 1 for detailed discussions on these points.

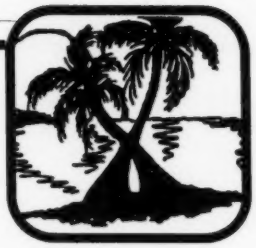
New PMO In New York

We are pleased to announce that Dan Pero has been selected to become the new PMO in New York City. We will have more information about Dan and a photograph in the Summer 1993, *Mariners Weather Log.*

BBXX	D.....D	YYGGi$_w$	99L$_a$L$_a$L$_a$	Q$_c$L$_o$L$_o$L$_o$
(Ship Report indicator)	(Call Sign)	(Day,Time, Wind indicator)	(Position Indicator, Latitude)	(Quadrant, Longitude)

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM JANUARY 1, 1993 TO MARCH 31, 1993

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ADVENTURER	WBM3015	CROWLEY MARITIME CORP	MIAMI, FL
AMERICAN MERLION	KUS9887	OSPREY SHIP MANAGEMENT, INC	SEATTLE, WA
AMULET	OYVW6	BRANDTSHIP USA, INC	JACKSONVILLE, FL
BETTY GALE	WR7615	GENERAL MARINE TOWING	CHICAGO, IL
BROOKLYN BRIDGE	EEZJ9	K-LINE AMERICA INC	SAN FRANCISCO, CA
BULWARK	WBM4113	CROWLEY MARITIME CORP	MIAMI, FL
CAPE HORN	KMJS	CAPE HORN, INTEROCEAN MANAGEMENT CORP.	NORFOLK, VA
CHIQUITA ITALIA	C6KD5	GREAT WHITE FLEET - CHIQUITA CENTER	BALTIMORE, MD
CHIQUITA JEAN	C6LK7	GREAT WHITE FLEET, LTD.	JACKSONVILLE, FL
CROWN PRINCESS	ELGH5	ELLER AND COMPANY//C/O GEORGE PARRA	MIAMI, FL
DEAN FOSS	WY3090	FOSS MARITIME CO	SEATTLE, WA
DEL MONTE CONSUMER	ELIU4	DEL MONTE TROPICAL FRUIT CO.	NEWARK, NJ
DEL MONTE TRADER	ELIU3	DEL MONTE TROPICAL FRUIT INTL	NEWARK, NJ
DELMONTE TRANSPORTER	ELIU2	DEL MONTE TROPICAL FRUIT CO	MIAMI, FL
ELSBORG	OWOS2	WECO AGENCIES (TEXAS), INC.	HOUSTON, TX
FOREST HAWK	ELIQ7	NORDIC ORIENTAL SHIP MGT PTE LTD	NEWARK, NJ
GLOBAL MARINER	KUS9897	TRANSOCEANIC CABLE SHIP CO.	BALTIMORE, MD
GRANDIS	3EQV8	WILLIAMS, DIMOND & CO.	SEATTLE, WA
GRIMSNIS	V2BN	GLOBE SHIP MANAGEMENT, INC	MIAMI, FL
HAWAII RESPONDER	KUS9831	CAPT.HARRY PHILLIPS LLL	NEW ORLEANS, LA
HERCULES BULKER	5MRQ	SUNRISE SHIPPING AGENCY INC.	SEATTLE, WA
INDIAN GOODWILL	ATRU	INDIA STEAMSHIP CO.LTD	NEW ORLEANS, LA
JEAN LYKES	WLAH	LYKES BROTHERS SS CO	NEW ORLEANS, LA
JEZERA DELMAS	J8FI2	BIEHL & COMPANY	HOUSTON, TX
KAHO	WZ2043	U.S. FISH AND WILD LIFE	CHICAGO, IL
LADY MARYLAND	WTU4008	LIVING CLASSROOM FOUNDATION	BALTIMORE, MD
LAKE	WMDY	AMERICAN OVERSEAS MARINE CORP.	SAN FRANCISCO, CA
LIBERTY VICTORY	DVHE	MYERS GROUP (US)	SEATTLE, WA
LOA	ELOF7	SOUTHERN SHIPMANAGEMENT	LOS ANGELES, CA
LONGAVI	ELOF6	SOUTHERN SHIPMANAGEMENT	LOS ANGELES, CA
LONTUE	ELOJ2	ROBERT C. HERD & CO., INC.	BALTIMORE, MD
MAERSK BOGOTA	V2MC	UNIVERSAL MARITIME	MIAMI, FL
NEW YORK SUN	WSKD	SOUTHERN STEAMSHIP//C/O KEVIN CHIPLOCK	MIAMI, FL
NOSAC ROVER	LAKA4	NORWEGIAN AMERICA LINE	JACKSONVILLE, FL
OCEAN EMPRESS	ELJU4	GENERAL STEAMSHIP CORP.	SEATTLE, WA
PC EXPLORER	3EYE9	NYK LINE (NORTH AMERICA INC.)	SEATTLE, WA
PEGGY ANN	WAW5723	GENERAL MARINE TOWING	CHICAGO, IL
PETER W. ANDERSON	WXQ7334	MAR INC-MARINE DIVISION	NORFOLK, VA
SANTA MERCEDES II	3ELQ2	TERMINAL SHIPPING CO., INC	MIAMI, FL
SEA COMMERCE	ELGH7	INCHCAPE SHIPPING	MIAMI, FL
SEA RACER	WX6371	CROWLEY MARITIME CORP	MIAMI, FL
SEA VALOR	WBN9212	CROWLEY MARITIME CORP.	SEATTLE, WA
SEABOARD GIGANT	OXGC2	SEABOARD MARINE LTD.	MIAMI, FL
SEABOARD HORIZON	9VKK	SEABOARD MARINE LIMITED/C/O BILL BYLUND	MIAMI, FL
SEABOARD OCEAN	OYMO2	SEABOARD MARINE LIMITED//C/O BILL BYLUND	MIAMI, FL
SKAUKAR	ELFZ8	S & C MARINE A. S.	JACKSONVILLE, FL
STAR DROTTANGER	ZCKU	STAR SHIPPING INC	SEATTLE, WA
STENA TRANSFER	ZCAF8	CROWLEY AMERICAN TRANSPORT, INC	MIAMI, FL
STRONG AMERICAN	WTF5189	BENGTSSON WALKER MARINE	JACKSONVILLE, FL
SUPERTEN	C6IH4	MORTON AND COMPANY	MIAMI, FL
TARGA	C6IZ6	CONTAINER SHIPPING	MIAMI, FL
TARPON SANTIAGO	C4OA	TARPONSHIP S.A.M.	NEW ORLEANS, LA
TRICORD SUCCESS	DUEH	WILLIAMS, DIMOND & CO.	SEATTLE, WA
TRIGGER	ELDU4	SOUTH ATLANTIC ENTERPRISES INC	SEATTLE, WA
TROPICAL BEAUTY	HQFT6	NATIONAL WEATHER SERVICE, PMO	SEATTLE, WA
TUZLA	P3DH4	KERR STEAMSHIP CO, INC.	MIAMI, FL
USCGC BLUEBELL	NODD	COMMANDING OFFICIER	SEATTLE, WA
USNS CAPABLE	NKSZ	MILITARY SEALIFT COMMAND	NORFOLK, VA
USNS CATAWBA T-ATF 168	NCDS	COMMANDING OFFICER	SEATTLE, WA
USNS COMFORT	NCOM	MILITARY SEALIFT COMMAND (USA)	BALTIMORE, MD
USNS MERCY	NMER	MASTER	SAN FRANCISCO, CA
USNS TIPPECANOE (TAO-199)	NTIP	COMMANDING OFFICER	NEW ORLEANS, LA
WILLIAM A. WHITNEY	WAZ8787	GENERAL MARINE TOWING	CHICAGO, IL
YOUNG SATO	3EFH4	TAIYO SANGYO TRADING & MARINE SERVICE LTD	SEATTLE, WA



Saison Cyclonique 1991–92 (Cyclone Season in the Southwest Indian Ocean)

Service Meteorologique
de la Reunion

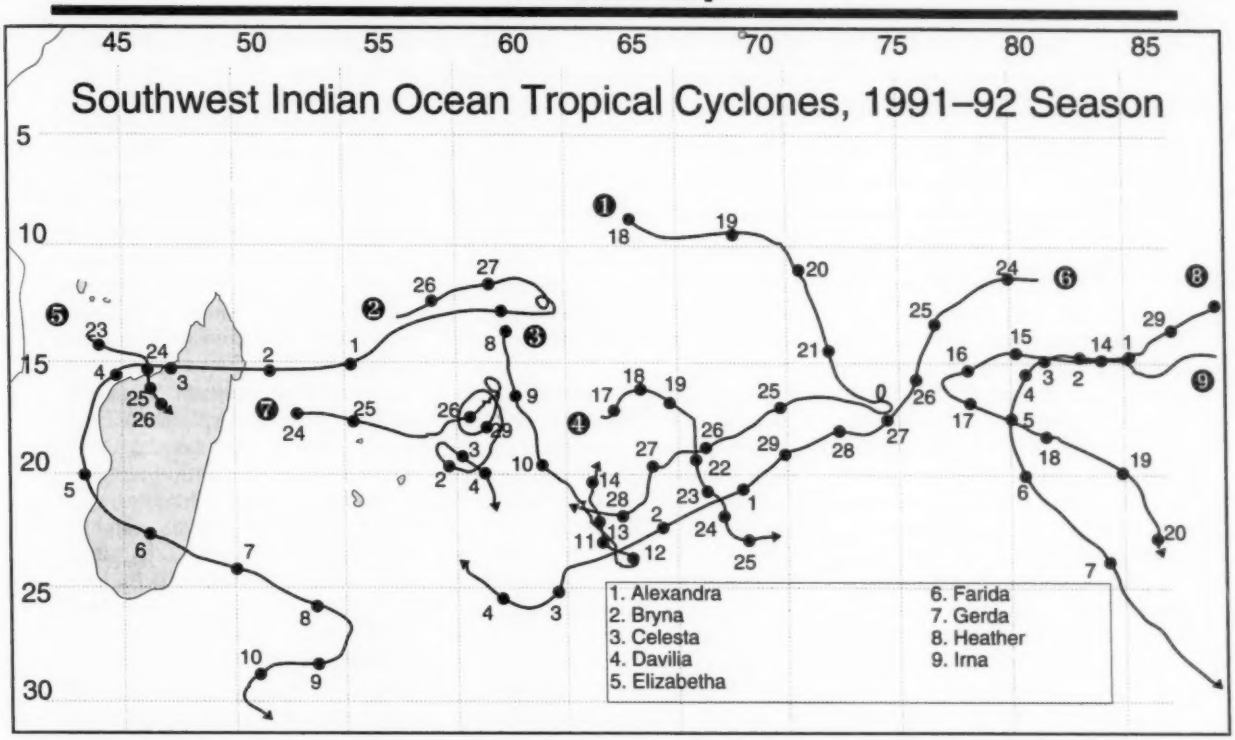
Although the Regional Tropical Cyclone Advisory Centre (RTCAC) of Reunion had tracked four tropical disturbances during October and November 1991, it wasn't until the 21st of December that the first name was used. In fact, post analysis revealed that the disturbance that formed on November 21, 1991 south of the Chagos Archipelago and was tracked until the 27th north of the Mascarenes, where it filled, could have been the first named depression of the season.

Finally, during the season which ended on April 19, 1992, ten depressions reached the moderate tropical depression stage (winds 34 to 47 knots) of which nine were named. There were three tropical cyclones (winds 64 to 90 knots), Farida, Heather, and Irna and all three of them occurred during the second half of the season.

The number of depressions this season was slightly above the 10-year mean although the number of days of cyclonic activity reached 34 this season as compared to the 10-year mean of 46. This contradiction may be explained by the fact that many depressions barely reached or didn't maintain their intensity as moderate depressions for very long. In fact, Celesta and Elizabetha attained that level for less than 24 hours, Davilia for 36 hours, and Bryna for less than 3 days.

Records date back to 1967 when the Meteorological Service of Reunion started to receive and interpret satellite data. Corresponding data already on file has been reexamined and reassessed in order that the annual statistics might be comparable.

It was observed that if disturbances which reached 2.5 on the Dvorak Scale (10-minute wind speed of 28 knots) were considered then the activity this season would be comparable to that of the 1990/91 season. However, the distribution of this activity was quite different. In 1990/91, the activity was fairly well distributed over the season, but in 1991/92 there was a marked clustering between the end of February and the beginning of March. Four disturbances coexisted during that period. Following the formation of Davilia, the Southwest Indian Ocean region underwent a period of exceptional cyclonic activity between the 21st of February and the 7th of March which saw the development of six depressions, five of which were named.



Alexandra

Alexandra became the first named tropical depression of the season on December 21, 1991. It was spawned near Diego Garcia in the Intertropical Convergence Zone. The depression became moderate during the night of the 19th as the NOAA 11 satellite imagery revealed the presence of an eye wall in its formative stages. The following day an eye was visible at 2200 UTC while an area of deep convection had concentrated in a small mass indicating that the depression was reaching its maximum intensity. The eastward movement of an upper trough outpaced the southward displacement of the depression so that the latter started to slow down and remain quasi stationary at 17°S for more than 24 hours. It then moved in a general westerly direction along the northern side of a subtropical anticyclone. That movement caused Alexandra to shear off quite markedly and by the 23rd the low level center was clearly outside the cloud mass that lay eastward of the disturbance. Alexandra continued to weaken during the next few days and dissipated. At peak intensity the winds (10 minute mean) reached 55 to 60 knots with gusts on the order of 80 to 85 knots. Minimum pressure was estimated at 972 millibars.

Bryna

As the remnants of Alexandra moved east of the Mascarene, a cloud cluster that was to become Bryna appeared north of Madagascar on the 23rd. By the 25th its center was determined by satellite and surface observations. Moving eastward it continued to develop with no change in intensity until the 28th. After stalling for nearly 24 hours, the intensification of a ridge of high pressure to the south caused the upper level flow to be reversed and the system began to backtrack toward the west on the 29th. The depression gradually accelerated toward the west southwest into a region where the sea surface temperature was running 28°C. It intensified slightly but was hampered by the fairly strong east to northeast flow that had established itself in the higher troposphere.

When the wind shear weakened on the 31st, the system intensified into moderate depression Bryna. Bryna came under the influence of a weak trough on the afternoon of the 31st and recurved toward the southwest. On the first day of the new year, it passed about 40 nautical miles north of Tromelin and the following day made landfall on the northeast coast of Madagascar. Bryna weakened as it moved inland, and its remnants emerged on the 3rd just

Southwest Indian Ocean Terminology

Weak Tropical Depression—A non–frontal synoptic scale low pressure area originating over tropical waters with organized convection and definite cyclonic circulation with wind estimated to be 33 knots or less.

Moderate Tropical Depression—A tropical storm in which the average wind speed is estimated to be 34 to 47 knots.

Severe Tropical Depression—A tropical storm in which the maximum of the average wind speed is estimated to be 48 to 63 knots.

Tropical Cyclone—A tropical storm in which the maximum of the average wind speed is estimated to be 64 to 90 knots.

Intense Tropical Cyclone—A tropical cyclone in which the maximum of the average wind speed is estimatde to be 90 to 115 knots.

Very Intense Tropical Cyclone—A tropical storm in which the maximum of the average wind speed is estimated to exceed 115 knots.

north of Majunga. It regained some strength over the warm waters of the Mozambique Channel, but as it moved down the west coast of Madagascar and around an upper level anticyclone, it did not intensify further. Because of a lack of observations it was difficult to determine what led to the violent development that was observed on the night of the 6th and the morning of the 7th southeast of Madagascar. However, the French Navy vessel ***Albatros*** encountered the depression during the night of the 7th and experienced near–storm force winds close to the center. The feeling is that Bryna was no longer a warm core depression but possibly a subtropical depression in its final stage of development. Nonetheless, it was a threat to shipping. The system recurved southward on the 9th and finally headed toward the westerlies the following day. While the storm was in its tropical stages, minimum pressure was estimated at 1005.3 millibars on the 1st when maximum winds (10 minute mean) reached 35 knots. Damage on land was mainly caused by heavy rains over northern Majunga where two deaths were reported.

Celesta

On the 6th of February 1992, a general fall in pressure was noted over the Mascarenes and this gradually extended to neighboring regions. This eventually led to the development of a large, complex poorly organized low pressure system some 550 nautical miles in diameter. On the 9th this area of convective activity became better organized and the center of the depression passed close to the east coast of Rodrigues during the night. Although the lowest pressure recorded at Port Mathurin was close to 995 millibars, the mean winds did not exceed 10 knots. During the next 24 hours, however, the depression intensified as it headed southeastward. On the 11th it was baptized Celesta as winds reached 34 knots. However, the system remained at this intensity until unfavorable upper level conditions on the 12th weakened the storm.

Davilia

Satellite imagery indicated that several centers of activity developed from time to time within the vast low pressure area that persisted after Celesta weakened, and eventually one took over on about the 21st. Convective activity became more organized and the depression deepened. A convective band about 40 nautical miles wide encircled the center of the depression on the 22nd. It reached the moderate tropical depression stage at about 1200 UTC and was named Davillia as it crossed the 20th parallel. Influenced by a trough, a low pressure to the south, Davilia moved rapidly south southeastward and came under a shearing influence caused by a west to northwest inflow in place of the upper tropospheric ridge. The disturbance disintegrated completely on the 23rd and 24th.

Elizabetha

During the third week of February, a strengthening of the pressure field over the equator produced an acceleration in the cross equatorial flow which resulted in the development of a broad area of convective activity between 10°and 15°S. Soon a cyclonic circulation became apparent in this cloud mass in an area where the sea surface temperatures were running about 29°C.

On the 23rd a center was located about 100 nautical miles southwest of Mayotte where the northwesterly flow had already reached 20 to 25 knots with gusts to 35 knots. As is generally observed in the Channel, cyclogenesis is rapid. During the night of the 23rd the depression reached moderate intensity and was named Elizabetha. It did not intensify further before making landfall on the northeast coast of Madagascar. Minimum pressure dipped to 998.6 millibars at Majunga at 1500 on the 25th and gusts reached 47 knots.

Farida

Farida was first detected on the 23rd approximately halfway between Diego Garcia and Cocos Island. Cloud bands organizing within a large area of thunderstorms were the first indications of a depression. On the 24th a vortex was clearly apparent on the NOAA 10 satellite imagery which showed bands of low clouds spiralling toward a center near 11.4°S, 84.7°E. A few ship observations, received at 0600 UTC, allowed a finer analysis to be made. The disturbance gradually intensified while turning toward the southwest and, on the 26th, a satellite image indicated a clear, regular but small eye. Farida had also broken away from the Intertropical Conver-

gence Zone and deepened 30 millibars in the past 48 hours. By the morning of the 27th, it had become a tropical cyclone (winds 64 to 90 knots). The passage of a subtropical high to the south caused a change in the movement of Farida toward the west. On the 28th it reached peak intensity when winds were estimated at about 80 knots with a minimum pressure of 941 mb. Gusts were estimated in the 125-knot range. On the 29th Farida resumed its movement toward the southwest and crossed 20°S during the day, and entered a large area of wind shear. Rapid disintegration occurred and within 72 hours the depression had dissipated.

Gerda

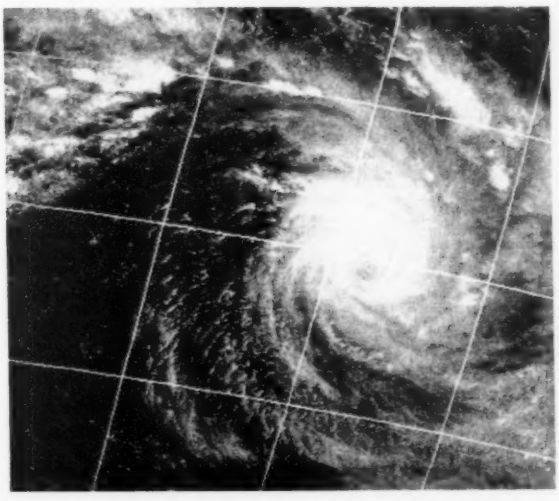
While Elizabetha was approaching the Malagasy coast and Farida was in its formative stages, a small vortex was observed on the 24th of February east of Madagascar. The vortex, which was moving east southeasterly, straightened its course on the afternoon of the 25th as it approached St. Brandon while under the influence of a ridge emanating from a strong anticyclone to the south of the Mascarenes. However, the steering flow weakened rapidly and the disturbance meandered in a complex triangle during the following week. Actually, there were two vortexes to monitor and it wasn't until the 29th that one took control and was named Gerda, which attained moderate depression status. The center continued to meander between St. Brandon and Rodrigues as it interacted with the remnants of Farida before crossing the 20th parallel and weakening on the 4th. Between the 29th of February and the 2nd of March, Rodrigues experienced sustained 10-minute mean speeds of 25 to 30 knots while gusts to 54 knots were recorded on the 29th and the 1st.

Heather

This depression formed in the Intertropical Convergence Zone about 270 nautical miles east of Cocos and intensified in the Australian area of responsibility. They named it Harriet and classified it as a tropical cyclone (hurricane strength) on the 28th of February. Harriet crossed 90°E near 15°S on the 1st of March and was renamed Heather. It continued to strengthen and became the most intense storm in the region during this season. Its lowest pressure was estimated at 930 millibars and maximum winds were estimated at 85 to 90 knots with gusts to 135 knots. The peak occurred on the night of the 1st and during the day on the 2nd of March. On the 3rd Heather slowed, recurved southwestward and weakened. The following day it accelerated southward and then recurved toward the southeast. By the 7th it crossed the 90°E line and moved back into the Australian area of responsibility. A bulletin from Perth indicated that the storm which had been weakening, reintensified on the 5th and once again became an intense cyclone. In the Australian region Heather transformed into a subtropical system which was moving along at 40 knots.

Irna

The development of Irna resembled that of Heather in that it formed north of Cocos Island in Australia's area of responsibility during the first week in April. It attained a moderate tropical depression stage on the 8th and was upgraded by Perth to a severe tropical depression the following day after being named Jane. Jane, which had been moving southward took a turn toward the west and, after crossing the 90°E longitude, it was renamed Irna on the 13th. Like Heather this was a very intense storm and its central pressure was estimated to be about 950 millibars on the 15th. Influenced by the approach of a well-marked upper level trough of low pressure Irna turned southwestward on the 15th and then toward the southeast the following day. The disturbance weakened very rapidly as a result of the shear caused by a northwesterly flow. By the 19th it left the Reunion area of responsibility as a weak storm.



This is Tropical Cyclone Heather at 0945 UTC on the 3rd of March 1992, in the visible channel. Heather has weakened considerably at this time. However, it would soon reintensify to its previous strength in slightly less than 48 hours.

Tropical Cyclone Names for the Northern Hemisphere — 1993 Season

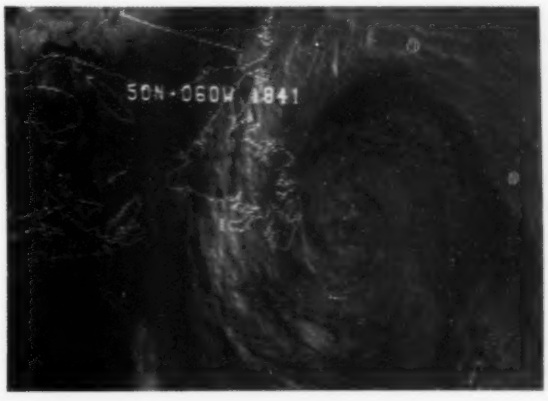
North Atlantic	Eastern N. Pacific	Western N. Pacific	Central N. Pacific
Arlene	Adrian	Hunt	Keoni (keh-OH-nee)
Bret	Beatriz	Irma	
Cindy	Calvin	Jack	
Dennis	Dora	Koryn	Li (LEE)
Emily	Eugene	Lewis	
Floyd	Fernanda	Marian	
Gert	Greg	Nathan	Mele (MEH-Lee)
Harvey	Hilary	Ofelia	
Irene	Irwin	Percy	
Jose	Jova	Robyn	Nona (NOH-nah)
Katrina	Kenneth	Steve	
Lenny	Lidia	Tasha	
Maria	Max	Vernon	Oliwa (oh-LEE-vah)
Nate	Norma	Winona	
Ophelia	Otis	Yancy	
Phillipe	Pilar	Zola	Paka (PAH-kah)
Rita	Ramon	Abe	
Stan	Selma	Becky	
Tammy	Todd	Cecil	Upana (oo-PAH-nah)
Vince	Veronica	Dot	
Wilma	Wiley	Ed	
	Xina	Flo	Wene (WEH-neh)
	York	Gene	
	Zelda	Hattie	
		Ira	
		Jeana	
		Kyle	
		Lola	
		Mike	
		Nell	

North Atlantic Weather October, November, and December 1992

October—This is usually a tough month over the North Atlantic. Besides the probability of winter storms, there is the lingering threat from tropical cyclones or their remnants. This year Tropical Storm Earl and Hurricane Frances brought this threat to life although Earl was confined to south of 30°N. The Azores–Bermuda High, usually just a faint memory, was analyzed at 1022–mb far north of the Azores close to where the Icelandic Low would normally reside. Naturally, the pressure anomalies (differences between the October and normal) were astounding, up to +16 mb more than normal just southeast of Iceland. Combine this with another strong climatic high over Greenland and the Icelandic Low was just a speck off southeastern Greenland. A few storms made it through the Denmark St. and along the major shipping routes, but not many.

The first significant blow to North Atlantic shipping traffic in October was delivered by a storm that flared up over the Yucatan Peninsula on the 1st. As it moved through the Gulf of Mexico and across the Florida Panhandle on the 3rd and 4th, its associated frontal system triggered an outbreak of tornadoes and intense thunderstorms along the west coast of Florida. NWS reported that five separate tornadoes touched down near St. Petersburg and at least 4 people were killed. At 1200 on the 3rd, the ***Marlin*** (28.2°N, 89.6°W) ran into 40–kn northerlies in 15–ft swells. The system moved out into the Atlantic off North Carolina on the 5th. At 1200 on the 5th, its central pressure was estimated at 1000 mb. By 1200 on the 7th, it had plummeted to 968 mb— 32 mb in 48 hr. By this time it was over the Grand Banks and platform and ship reports were flooding in. At 1800 on the 7th, the CGIZ4 was encountering 56–kn southerlies in 17–ft seas with a 975–mb pressure near 48°N, 49°W. Two hours earliest the CDGV (47°N, 49°W) measured 57–kn south southeasterlies with a 974–mb pressure in 15–ft seas and swells estimated at 36 ft. However, instead of continuing northeastward toward the Denmark St. as is normal, that area was under the protection of a 1037–mb High so the storm was forced eastward and then southward, ending up near the Azores on the 14th as a weakening Low.

To break the stranglehold that the High was exerting over the eastern North Atlantic, it took a storm to form in the Denmark St. it self on the 11th. By the 13th, the short–lived 990–mb Low had tracked eastward (not shown on the



On the 7th of October the Low was over the Grand Banks with a 962–mb center. The visible shot was taken at about 1840 on the 7th.

track chart however) and it was generating strong winds to the west where its gradient was tightened by a 1054-mb High over Greenland and the 1037-mb High still holding sway southwest of Greenland. This combination of Highs dominated the weather for the next week.

However, things were far from quiet over the Great Lakes. On the 16th at 0300, a 1010-mb Low was analyzed over southern Lake Michigan. This system deepened as it moved northeastward across Michigan and Lake Huron. By 1500 its 1000-mb center was located over southern Ontario just southwest of Sudbury. It continued to deepen and by 0600 on the 17th central pressure dipped to 989 mb just east of James Bay. Gales occurred over Lakes Erie and Ontario as well as the eastern portion of Lake Superior and the northern portions of Lakes Michigan and Huron. In some locations sustained winds reached 48 kn and on Lake Michigan 35 mi west northwest of Grand Traverse Light a 50-kn northwesterly was reported. At 0300 on the 17th, the ***Cason J. Callaway*** (43.9°N, 82.6°W) ran into a 40-kn westerly in 5-ft seas. At 2100 on the 16th, the ***Edwin Gott*** (45.5°N, 86.4°W) reported a 50-kn northwesterly in 15-ft seas. The system continued to slowly intensify as it moved away from the Great Lakes. By 0000 on the 18th, its 981-mb center was moving northward along the eastern shores of Hudson Bay. While the Great Lakes were out of harm's way, vessels in the Labrador Sea and Baffin Bay were experiencing gales.

A storm that can be traced back to south of Lake Winnipeg on the 20th made it most of the way across the Atlantic without hardly a peep, but then quickly developed between Iceland and Greenland on the 27th. At 0600 on the 27th, the GCLC (61°N, 1°E) ran into 40-kn south southeasterlies in 15-ft seas. The ***Cumulus*** (56°N, 19°W) reported 47-kn north northwesterlies in 17-ft swells at 1900, and several vessels and platforms were measuring pressure around 980 mb. Platform 62118 (58°N, 1°E) at 0000 on the 28th measured a 977-mb pressure in 45-kn winds. The situation was complicated somewhat by an active Tropical Storm Frances to the southwest, until about the 28th. The storm continued to intensify as it moved over England on the 28th and a 976-mb pressure was estimated at its center based upon ship and platform reports in the North Sea. As the month came to a close it was replaced by a weaker secondary center in the Baltic.

Casualties– The bulk carriers ***Whitefish Bay*** and ***Stadacona*** under tow of the tug ***Umka*** broke their tow on the 7th near 46.5°N, 54.5°W in 57-kn winds and 18- to 20-ft seas. The ***Stadacona*** was later rescued. The barge ***Gulf Fleet*** 263 broke a tow on the 14th in the Bay of Campeche and drifted ashore. On the 15th the self-elevating drill platform ***West Omikron*** was under tow of two tugs off Scotland but drifting toward land in 35- to 50-kn winds and 18-to 20-ft seas. Non essential personnel were evacuated until the weather eased. The MV ***Aidak*** grounded off the coast of northwest Turkey in the Black Sea due to strong winds on the 15th. Another Black Sea storm swamped the Georgian vessel ***Argo,*** packed with 240 refugees off the Georgian coast. The ro ro ferry ***Lancut*** bound for Copenhagen with 300 passengers and crew, trucks and vehicles grounded a few miles of Copenhagen in heavy weather on the 28th. It was refloated later.

November–The Icelandic Low was phenomenal this month with a 988-mb pressure over Iceland. This is a good 12 mb deeper or more intense than normal– that's a lot of millibars. To add to this devastating climatic scene, the Azores-Bermuda High was reminiscent of midsummer with a 1024-mb center off Spain (6 mb more intense than normal) and a 1020-mb center off the U.S., slightly higher than normal. Despite the fact the high pressure usually presages good weather, the pressure gradient between the Spanish High and the Aleutian Low was steep to say the least. Climatically, and in the real world, this is an indicator of strong winds north of 40°N from Newfoundland to the Baltic. This November these strong winds were generated by a few very intense storms with centers of 950 mb or below. The Great Lakes also had its share of rough weather.

A storm which had intensified over Arkansas on the 1st moved northward and crossed over the western Great Lakes on the 3rd. During this period, it deepened from 1000 mb at 1200 on the 1st to 988 mb at 1800 on the 2nd near La Crosse, WI. Winds over the western Great Lakes on the 2nd and early on the 3rd, ranged from 35 to 45 kn as reported by vessels such as the ***Edwin Gott***, ***Phillip R. Clarke***, ***Doan Transport***, and the ***James R. Barker***. Seas ran 8 to 15 feet. The ***A. G. Farquharson***, at 1200 on the 2nd, on Lake Huron encountered a 50-kn easterly and this was confirmed by the ***Algorail*** nearby which came in with 48 kn. The storm began to weaken late on the 3rd.

Lee Radzick at Minnesota's Split Rock Lighthouse gives this description of the storm:

Although not a single person was seen braving the elements at Split Rock Lighthouse Historic Site on Monday, November 2nd, it proved to be a lively day at the 83-yr old light station. On Sunday, November 1st, winds began to build out of the northeast and the seas began to rise as they rolled in across 300 mi of open water.

By midnight of Sunday night the weather station at Split Rock clocked the peak wind gust at 73 mph out of the northeast, with sustained gusts (4 Sec. or more) at 59 mph. It was obvious that we were in for the first winter gale of the season.

While this year's first lake storm was not as intense or prolonged as the "Mataafa" Blow of November 27-28, 1905 or other megastorms in 1913 or more recently, it could be compared with the storm of November 9-10, 1975, which is famous for taking the ***Edmund Fitzgerald****.*

By daybreak on Monday the winds were still exceeding 70 mph at Split Rock and the seas had built to over 20 ft. All day Monday it continued to blow snow and rain. Doors to the keeper's dwelling had to be locked to keep them from blowing open and the windows in the house would rattle when the huge swells slammed into the cliff. Although the lighthouse sits atop a 130-ft cliff, the waves pounding the shore would climb the cliff face and cover the fog signal building and lighthouse with spray.

On the ship-to-shore radio channel a message from a 1000-footer that had just rounded the Apostle Is. upbound for Two Harbors was received. The captain stated that the waves were over 20 ft in height and that they were beginning to crown. He calmly commented that he'd hate to have to turn around in heavy seas and that he was carefully tending both engines in case he needed them.

While by far not the largest storm to the the lake, Walt Sve, a commercial fisherman who owns a local resort, Split Rock Cabins, took a break from reinforcing his fish house against the waves to say that he hadn't seen seas like this on the lake since 1975.

The North Atlantic was not asleep during this period either. A Low developed off Cape Hatteras on the 1st and headed east northeastward. From a 984 mb central pressure at 1200 on the 2nd, it plunged to 968 mb by 1200 on the 3rd east of the Grand Banks. This monster for a day did not go unnoticed by mariners. Wind reports of 45 to 55 kn in the vicinity of 45°N, 45°W were plentiful and there were several reports of seas greater than 30 ft. The ***Queen Elizabeth II*** (47°N, 49°W) at 1800 on the 3rd reported a 60-kn north northwesterly in 36-ft seas and consistently reported these conditions throughout the day. The ***Mette Maersk*** (47°N, 50°W) at 0600 had measured a 55-kn northerly and the ***Nosac Ranger*** (46°N, 47°W) at 1400 on the 3rd observed a 55-kn northerly with a 978-mb pressure in 30-ft swells. Storm force winds (more than 50 kn) continued into early on the 4th, but fortunately dropped to gale force during the day as the storm meandered northeastward and weakened.

This storm developed southeast of Cape Cod on the 6th and moved rapidly toward Greenland over the next 2 days. This *Nantucket Express* deepened as fast as it moved. From a 996-mb central pressure at 1200 on the 6th, it dropped to 972 mb in 24 hrs. and to 954 mb by 1200 on the 8th and that's a 42 mb drop in 48 hrs. The storm slowed dramatically as it approached southeastern Greenland. The ***DSR Baltic*** gave an indication of the storm's strength at 0600 on the 7th near 48°N, 40°W when it ran into a 48-kn southerly in 13-ft seas. The ***Manfred Shaun*** (62°N, 30°W) at 0900 on the 8th measured a 78-kn southerly in 18-ft seas with a 973-mb pressure in moderate rainshowers. In general winds were in the 40-to 50-kn range with seas running 15 to 25 ft. The storm meandered east northeastward over the next several days and filled quite rapidly.

Early on the 13th a northward-moving deepening 985-mb Low crossed Lake Huron east of Alpena, MI. By the time it reached the James Bay region late in the day, its pressure had dipped to 962 mb– a drop if 19 mb in 15 hrs. The ***Capt. Henry Jackman*** (43.8°N, 76.9°W) on Lake Ontario ran into 50-kn west southwesterlies in 10-ft seas at 1200 on the 13th. There were several other reports of storm force winds but most were 35 to 50 kn. At 0300 on the 13th, the ***Edgar B. Speer*** (44.2°N, 87.2°W) on Lake Michigan had 52-kn winds in 16-ft seas. Gales began around 0000 on the 13th over Lakes Superior, Michigan, and Erie and lasted until about 2000.

An innocuous Low moved across the North Atlantic on the 16th and 17th. As it approached the Faroe Is on the 18th, the bottom dropped out as its pressure fell to 966 mb by 1200. This led to an outbreak of gale and storm force winds over the North and Norwegian Seas and even into the Mediterranean. This situation persisted into the 19th. At 0100 on the 19th, the MPRL6 (59°N, 3°W) was clobbered by a 60-kn southwesterly in 13-ft seas while the platform 62404 (55°N, 5°E) measured a 54-kn westerly. The GUWK (55°N, 3°E) ran into 20-ft seas at 0600. Winds in the 45- to 65-kn range persisted through the 19th. Platform 62145 (58°N, 0°) was belted by 65-kn west northwesterlies at 1200 and several other reports of this magnitude were received. This was a wicked storm well into the 20th.

By this time another system was moving northwestward

from the mid Atlantic toward Iceland. This storm actually came from the heartland of the U.S., but once again did not intensify until east of 40°W. On the 21st its central pressure dipped to 968 mb and fell to 964 mb the following day when it was absorbed into a system that had come to life over the Azores on the 21st. This new super storm dipped to 950 mb by 1200 on the 25th. On the 22nd the GACA (57°N, 24°W) at 0000 measured 48-kn south southwesterlies, a 981-mb pressure and 25-ft swells. Early the following day 40- to 55-kn winds were being reported by vessels in the Norwegian and North Seas and up to 65 kn in the eastern North Atlantic between the Azores and Iceland. The whole area was under siege as seas ran 15 to 30 feet. Pressures were falling dramatically. At 1800 on the 23rd, the ***Dettifoss*** reported a 942 mb reading near 63°N, 15°W while nearby the ***Ada Gorthon*** (62°N, 18°W) had a 954-mb reading in 62-kn winds and the TFNA (66°N, 14°W) registered 964 mb in 52-kn winds. This was in line with the 940-mb center near 61°N, 17°W at 1200. This Azores storm continued north northeastward and moved past the east coast of Iceland early on the 24th. While it remained potent, at 956 mb, another strong storm was following in its wake. This system had formed over New Brunswick, Canada on the 21st and moved eastward across the Atlantic as a rather weak Low until late on the 23rd when it turned northward and began to deepen. By 1200 on the 24th it was down to 966 mb near 57°N, 16°W. Some 24 hrs later it had plummeted to 950 mb as it approached Iceland. There was basically no recovery time for sea and swell in this area, and winds remained in the 40- to 55-kn range while seas of 20 to 30 ft were common. The ***Magnus Jensen*** (60°N, 10°W), at 0300 on the 25th, recorded a 967-mb pressure in 45-kn winds and 33-ft seas. The ***Gauss*** (60°N, 3°E) measured 54-kn southeasterlies. The storm and its associated frontal system were generating these horrendous conditions as far south as the Bay of Biscay. The heart of the shipping lanes to and from Europe were under siege through the 26th to say nothing of the oil platforms, which can do little to avoid these conditions. The weather finally began to ease late on the 26th.

Before the month was out one more shot was delivered to the seas east of 45°W. This storm originated in southern Colorado on the 23rd. After moving across the Great Lakes on the 26th, it skimmed across the Gulf of St Lawrence the following day and then began to deepen. From 998 mb at 1200 on the 27th, it dropped to 952 mb in 24 hr and to 932 mb in 48 hr. Talk about explosive deepening. That's 56 mb in 48 hr. On the 28th the monster slowed considerably as it deepened. Winds in the 60-kn range were being encountered south of the center so when the ***Ironbridge*** (57°N, 28°W) reported a 70-kn southerly in 33-ft seas with a 962-mb pressure, it was believable. This location was somewhat east of the center. At 932 mb on the 29th this system most likely qualifies as the most intense winter storm of the season— a storm to avoid at all costs. Few ships ventured close to this storm on the 29th or if they did they were too busy to report weather. The ***Magnus Jensen*** (61°N, 39°W), about 60 mi west of the center, reported 58-kn winds in 30-ft seas at 1200. Farther south 50-to 55-kn wind reports were common. At 1500 on the 29th the ***Jokulfell*** (57°N, 35°W) reported 60-kn southwesterlies and a 944.5-mb pressure within about 100 mi of the center. Central pressure was still estimated at 936 mb at 0000 on the 30th near 59°N, 32°W. Gales extended out 900 mi to the south of the center. Storm force winds were being reported far to the east in connection with the circulation and associated frontal system moving through the Norwegian Sea. At 0600 the GACA (57°N, 24°W) measured 42-kn winds, a 965-mb pressure and 20-ft seas. By 1200 their winds were up to 55 kn and they were battling 31-ft seas. Storm force winds ushered November out as the storm filled all the way to 952 mb by the end of the month. It wasn't quite through though. Stay tuned for next month.

Casualties—On the 7th the mv ***National Star***, while leaving Sidon port, Lebanon in rough weather, struck the berth with its bow and sank in shallow water. Severe force 10 winds struck the Netherlands on the 11th killing two people while disrupting rail and road traffic. In Germany at least one person was killed when winds up to 92 kn swept across the country tearing roofs off houses and knocking down trees. Several vessels along the coast broke moorings. The tanker ***Alpha Intelligence*** grounded at Santa Panagia, Italy on the 14th in heavy weather. The mv ***Charm*** sank near 44.3°N, 15.5°W after taking on water in poor weather conditions on the 24th. Four survivors were rescued, three bodies were recovered, and five people were missing. The ***Katya Va*** bulk carrier bound for Spain ran aground in fog on the 26th near the Choptank River in the Chesapeake Bay. It was refloated the following day with no oil spill.

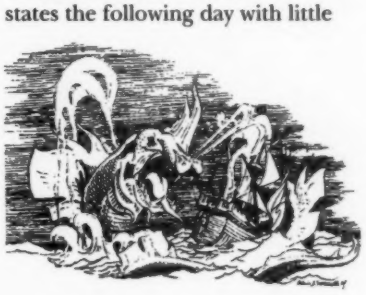
December– A 992-mb Icelandic Low was centered just off the southeast coast of Greenland with secondary centers east of Iceland and in the Barents Sea. While the Icelandic Low usually dominates the climatic chart in December, these pressures were 6 to 10 mb deeper than normal, while the Azores-Bermuda High was stronger than normal, resulting in a tight pressure gradient north of 45°N.

November went out like a lion. Its legacy to December was a 956-mb Low centered just south of Iceland. This storm spent the first 5 days of the month terrorizing shipping over the northern lanes as well as fishing vessels, rigs and platforms in the North and Norwegian Seas. Representative of the reports received was that of the ***Olive Ace*** (45°N, 4°E) which measured 49-kn southerlies in 13-ft seas at 1800. In the Norwegian Sea, the ***Pechenga*** ran into 43-kn winds in 20-ft seas. Conditions didn't improve on the 2nd. Winds, in general, were in the 40- to 50-kn range, but there was no shortage of storm force winds as the 956-mb center moved eastward and then started to recurve the following day. At 1800 on the 2nd, the ***Drupa*** (61N, 4°E) indicated 55-kn southerlies with a 965-mb pressure in 20-ft seas. The ***Heidelberg Express*** ran into a 58-kn southwesterly near 46°N, 16°W while battling 33-ft seas at 1800 on the 3rd, and these conditions were confirmed by the ***Pholas*** nearby. On the 3rd the central pressure was estimated at 949 mb. The November monster skulked east of Iceland on the 4th and 5th as it finally began to fill. But this was of little consolation to the rigs and vessels that had been battling storm force winds and 15 - to 25-ft seas and swells for 5 days.

A wicked storm began to intensify in the Gulf of Maine on the 5th. It had originated just west of Hudson Bay, swung down across the northern Great Lakes on the 4th and off the coast the following day. However, it wasn't until the 6th over the Gulf of St Lawrence that things really started to pop. From a 964-mb center at 1200 on the 6th its central pressure fell to 949 mb in 24 hrs. Across the ocean a double-barreled Low bearing down on England and the North Sea was generating gale-force winds.

The Gulf of Maine storm, meanwhile, was generating storm-force winds south of its center. At 1800 on the 6th the 4XGY (41°N, 46°W) measured 52-kn southerlies in 17-ft seas at 1800 while the DGNB (42°N, 45°W) measured 50-kn winds in 20-ft seas a short distance away. These conditions were typical. Things worsened slightly on the 7th, and the ***Arabian Senator*** and ***Abitibi Orinoco*** at 1200 near 49°N, 46°W hit 55-to 60-kn winds in 30-ft swells– this was about 400 mi southeast of the center. The system continued northeastward and eventually through the Denmark St on the 10th. However, by this time conditions had improved.

Monster of the Month–On the 9th a Low crossed Texas and moved eastward across the Gulf Coast states the following day with little



intensification. By 1200 on the 10th, it reached southeastern Georgia spreading rain and snow into the southern and mid Atlantic states. Now the storm began to deepen rapidly. By 0000 on the 11th, it had moved to near Richmond, VA and its central pressure fell 14 mb in 12 hr to 995 mb. To the north a large surface High had moved to near Anticosti Is off the coast of Quebec and stalled with a central pressure of over 1035 mb. The combination of an intensifying cyclone and the shrinking distance between the two systems resulted in a significant increase in the pressure gradient between over the mid Atlantic region. By 0000 on the 11th, winds had reached gale force and were continuing to increase both in strength and coverage from Virginia to New Jersey where gusts of 40 to 60 kn were common. The ***Marlin*** off Cape Hatteras at 0000 on the 11th ran into a 45-kn south southeasterly in 17-ft seas. At 0300 the ALSN6 off New Jersey measured 4e5-kn easterlies in 15-ft seas. Three hours later winds were up to 51 kn while seas were running 17 ft. The Low moved to the northern end of the Chesapeake Bay by 1200 on the 11th and deepened another 10 mb to 985 mb, which further tightened the pressure gradient. Gale to storm force winds spread to southeastern New York and hurricane force gusts were blowing along the coast. During the day the monster slowed and meandered as the High remained stationary. Winds at LaGuardia Airport, NY remained above 40 kn for most of the day while Ambrose Light had a peak gust of 80 kn at 1800. The ALSN6 measured winds at 62 kn at 1800 near 40.5°N, 73,8°W while other ships nearby were encountering 40- to 50-kn easterlies. Early on the 12, the center was located along the Maryland coast and began to weaken while a new center formed offshore. The storms

The December Monster of the Month was captured by photographer James Redman of Hull, MA. This scene is at Hull on the 13th.

pressure gradient and the long offshore fetch combined to generate strong winds and damaging surf from New Jersey to Maine with strongest winds now being felt over eastern New England by 1200 on the 12th. By late in the day, there were three separate centers off New England and the mid Atlantic coasts and winds were beginning to diminish. In preliminary estimates some 19 deaths were attributed to this storm and severe coastal flooding contributed to a preliminary damage estimate of $1 to $2 billion. In the northeast highways were submerged, airports shut down, subways and train service suspended, and power cut to thousands of residents. Some inland areas received up to 3 ft of snow. A barge slammed into the Tappan Zee Bridge over the Hudson River, closing it for more than an hour. The Port of New York was severely disrupted as was the Staten Island Ferry. Hundreds of Massachusetts residents were evacuated either because of coastal flooding or because heavy wet snow snapped power lines. High tides contributed to heavy flooding in communities north and south of Boston, including Hull, Revere, Scituate, and Quincy. On the resort island of Nantucket at least five homes were washed into the sea and erosion was severe on the eastern end of Long Island as well. The storm carved two new inlets in the narrow barrier beach at Westhampton and dozens of homes were destroyed both there and on Fire Island. The worst hit was the Westhampton area known as Dune Road, where more than 90 homes have been lost since 1991 and scores more held up by wooden pilings once sunk in deep sand are stranded in the surf zone.

During the second half of the month, the Icelandic Low was born as almost every major storm moved up the southeast coast of Greenland and into the Denmark St. This was no time to be sailing anywhere between the Grand Banks and the Denmark St. The only severe storm of the second half

that didn't move in that direction was one that moved west of England and into the Norwegian Sea on the 17th and 18th. It really intensified on the 18th just north of the Faeroe Is as pressure fell to 952 mb at 1200 on the 18th. It generated gale-force winds from northern Norwegian Sea to the south of the Azores along its front. The storm continued to generate storm force winds for several more days. The UTNE (69°N, 35°E) battled 58-kn westerlies in 12-ft seas at 1800, while the EWJQ (70°N, 37°E) hit 54-kn northwesterlies at 1200 on the 20th. Storm-force winds were experienced in the Norwegian and northern North Seas. By the 19th the 956-mb system was moving into the Barents Sea.

The siege from Newfoundland to the Denmark St began on the 18th when a 992-mb Low moved out of the Gulf of St. Lawrence along the 60th parallel where its central pressure fell to 942 mb by the 20th. It was a compact system and ship reports were scarce from this region. However, at 2100 on the 21st the OWDG reported in with a 68-kn west northwesterly near 55°N, 56°W and a 989-mb pressure. There winds fell to 60 kn by 0900 on the 22nd. However, by this time a storm that had moved off Labrador on the 21st had become the dominant center with a 946-mb pressure as it hugged the southeast coast of Greenland for several days. The ***Nuka Ittuk*** (59°N, 37°W) at 2100 on the 22nd was raked by 52-kn westerlies in 26-ft seas. The ***Jokulfell*** sent in a good series of reports on the 22nd and 23rd as it headed toward Iceland. Their winds range from 44 to 52 kn about 400 mi east of the center.

There was a brief respite on the 24th and 25th but by the 26th a 960-mb Low, which had originated east of Cape Hatteras, was heading toward the Denmark St. At this time it was generating gale-force winds and 10- to 20-ft seas. At 0700 the ***Algobay*** (40°N, 68°W) measured 43-kn westerlies in 23-ft seas. This storm hit its peak on the 26th and actually weakened slightly as it neared the Denmark St. However, gales reports remained frequent. A couple of moderate storms followed this one and as the year came to a close a 962-mb center was located just north of 60°N near 40°W, and some ships celebrated New Year's Eve in 45-kn winds and 15- to 25-ft seas.

Casualties– In early December the Greek tanker ***Aegean Sea*** in poor visibility and a rain squall with force 9 winds ran aground at La Coruña, Spain spilling 70,000 tons of crude oil. There was no loss of life on board the tanker. On the 10th, in stormy conditions the 600-ft ro ro container vessel MSC ***Chiara*** was deliberately put aground in Buzzards Bay after the vessel struck rocks or an obstruction coming out of the west end of Cape Cod Canal and started to take on water. The 140-ft tugboat ***Offshore Monarch*** went aground near Cuttyhunk Is while trying to recover a runaway barge in stormy conditions. On December 11th the powerless 750-ft freighter ***Cape Hudson*** was being towed to Newport News when it broke its tow in 50-kn winds and was pushed downwind to within 7 mi of Parramore Is, VA before it was recaptured with the help of the Coast Guard. On the 14th the mv ***Winnipeg*** grounded on sand bar at the north end of Belle Isle in the Detroit River in dense fog. It was successfully refloated on the 18th. The mv ***Clydebank*** suffered heavy weather damage on the 14th during the passage from LeHarve to Cristobal. In heavy fog the mv ***Juraj Dalmatinac*** and tank barge Duval 2 collided in the Houston Ship Channel on the 22nd.

Satellite Data Services Division

This satellite shot of the Monster of the Month was taken on the 11th at about 1730. This was close to the time that Ambrose Light was reporting a gust to 80 kn.

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports, and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month.

–ed.

North Pacific Weather October, November, and December 1992

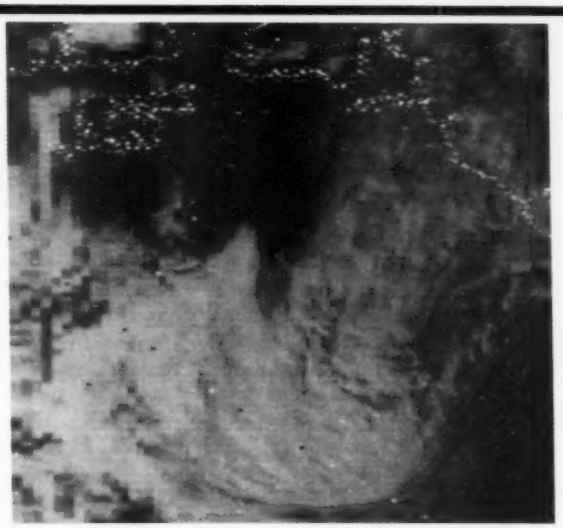
October–This was a month dominated in the Pacific by a bevy of hurricanes and typhoons and a few potent extratropical storms for good measure. The only indication of all this activity on the average pressure chart was the Aleutian Low, which was a little deeper than normal in the Gulf of Alaska, resulting in negative pressure anomalies over most of the northeastern North Pacific. Tropical cyclones very rarely influence the mean pressure charts although small negative anomalies did show up west of the International Dateline along the 20th parallel with a 1008–mb center located just east of the Philippines.

In the eastern North Pacific tropical cyclones included Tina, Virgil, Winifred, Yolanda, and Zeke, while western waters were dominated by Ward, Yvette, Zeke, Angela, Brian, Colleen, Dan and Elsie.

The month opened with a large 978–mb storm from September streaking eastward across the Bering Sea. Its circulation reached into the northern shipping lanes and with a huge 1035–mb High dominating the mid latitudes, a tight pressure gradient was evident south of the Aleutians. This resulted in a brief period of gales, and seas up to 15 ft were encountered on either side of the Dateline between 40° and 55°N. Typical, was the report from the XYKH (54°N, 158°W) which measured 45–kn winds in 15–ft swells. A strong cold front which stretched from Kamchatka Peninsula along the Japanese Islands was also creating some rough weather conditions in western waters as testified to by the JAON which ran into 52–kn winds near 40°N, 152°E at 2100 on the 2nd. In the tropics Typhoon Ward and Hurricane Tina were causing trouble. Condition eased somewhat over northern waters during the next few days as several moderate Lows moved into the Bering Sea and across the northeastern North Pacific. One of some interest intensified in the northern Bering Sea and when its center reached the Chukchi Sea on the 7th it was down to 966 mb. Its circulation covered the Bering Sea and beyond. To the south, near 43°N, 167°E were the 988–mb remnants of former Typhoon Ward which were slowly dying out as an extratropical storm. By the 10th Yvette was at typhoon strength just east of Luzon, while Hurricane Winifred had moved inland near Acapulco, Mexico. A large High dominated most of the Pacific except for a relatively weak Low off Hokkaido. During the next several days Yvette grew to super typhoon intensity (winds of 130 kn or more) and it headed slowly northeastward. A Low which had developed near 39°N, 173°W on the 11th and headed northward was at 986 mb on the 15th near 50°N, 158°W and was creating some weather over the northeastern North pacific. Winds were being received in the 40– to 45–kn range with swells of 10 to 15 ft, mainly to the east of the center in conjunction with a frontal system. By the following day, however, it was weakening. Yvette also weakened as it moved east northeastward and turned extratropical.

By the 19th two large Lows dominating the weather picture from Japan to the Gulf of Alaska. One 984–mb center was located over the western Aleutians while a 961–mb center, which had just developed the day before, was located near 53°N, 140°W. An excellent report came in from the

This Low in the Gulf of Alaska on the 19th at about 2300 was part of a double-barreled system with the other center over the western Aleutians. The Gulf of Alaska center had a pressure that was estimated at 961 mb. Below is a barograph chart from the ***Lake Charles*** *with a trace of Typhoon Colleen on the 24th.*

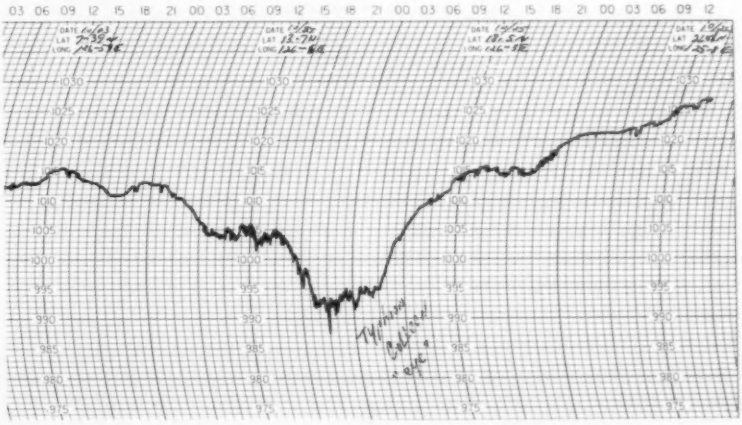


Sattelite Data Services Division

WNHL at 1200 on the 19th at 52°N, 134°W. They measured 48-kn south winds and a 980-mb pressure in 20-ft seas about 180 mi east of the center. At 1200 on the 20th, the ***Japan Rainbow II*** (56°N, 140°W) reported a 971-mb pressure in 40-kn winds while the ***Great Land*** 3 hrs later near 57°N, 143°W had a 966-mb reading in 13-ft seas. This storm was for real. It recurved into the Gulf of Alaska on the 20th and fortunately weakened as rapidly as it developed. East of the Philippines, Typhoons Colleen and Brian were creating some problems.

This storm came to life off Tokyo on the 19th as an atmospheric wave along a front. Moving eastward it showed signs of organizing on the 21st as central pressure dipped to about 990 mb. By the 23rd, all hell broke loose as the system crossed the 45th parallel near 175°E. At 0100 the A8VI (41°N, 179°W) measured a 60-kn southerly in 17-ft seas. The ***Nosac Explorer*** had encountered 53-kn winds in 21-ft swells with a 982-mb pressure just 1 hr before. By 1200 the storm's central pressure was estimated at 958 mb as it headed to the eastern Aleutians. Winds of 40 to 60 kn were common along with 15- to 20-ft swells. On the 24th things began to calm down as the 960-mb system moved across Bristol Bay and up the west coast of Alaska. It would have qualified as Monster of the Month had it lasted another day.

Of the eight tropical cyclones, five attained typhoon intensity over the western North Pacific and South China Sea during October. Ward was a typhoon which developed in September but lasted until the 7th, when it became an extratropical cyclone east northeast of Tokyo on the 7th. A day later Yvette formed some 500 mi east of Manila and headed westward. Yvette started to recurve on the 11th just after attaining typhoon intensity about 280 mi east northeast of Manila. It passed just to the north of the Ogasawara Is on the 17th before weakening to a tropical depression that night. Typhoon Brian formed about 820 mi east southeast of Guam on the 17th and headed westward. It hit Guam as a severe tropical storm on the 21st and then moved toward the north northwest and attained typhoon intensity on the 22nd about 220 mi northwest of Guam. It recurved northeastward on the 24th and weakened to a severe tropical storm that evening. Accelerating, Brian continued to weaken and finally dipped to a tropical depression some 400 mi east southeast of Tokyo on the 25th. Colleen became a typhoon on the 22nd as well, but it was some 580 mi east of Manila at the time. Colleen took a northward track but turned west northwestward the following day. It finally crossed central Luzon as a severe tropical storm bringing heavy rains to the Philippines on the 26th and then moved across the South China Sea as a tropical



storm. Dan formed as a tropical depression on the 25th near the International Dateline. After intensifying to a tropical storm the next day it reached typhoon strength on the 27th some 335 mi southeast of Wake Is. and became a slow-moving typhoon on the 29th and started to track toward the west southwest. Still maintaining typhoon intensity, the last day of the month saw Dan turn toward the west northwest and the Ogasawara Is.

Casualties—The fishing vessel ***Jung Yang*** No. 3 sank in rough seas off the east coast of Korea on the 13th. Only four of the twenty-two crew members were rescued. On the 8th the port of Manzanilla was closed as 13-ft seas crashed ashore when Hurricane Winifred moved inland. On the 10th central Vietnam suffered its worst flooding in 40 yrs and at least 37 people were killed. The ore carrier ***Dae yang Honey*** was listed as missing with a crew of 28 on the 24th off Guam. The U.S. Coast Guard sighted debris close to the position indicated by the EPIRB which was close to the path of Typhoon Colleen. An inflated life raft from the vessel was found near 12.5°N, 132°E on the 26th and another empty life raft was found by its sister ship ***Bum Ju***. After no further luck in searching for survivors, the search was suspended on the 31st.

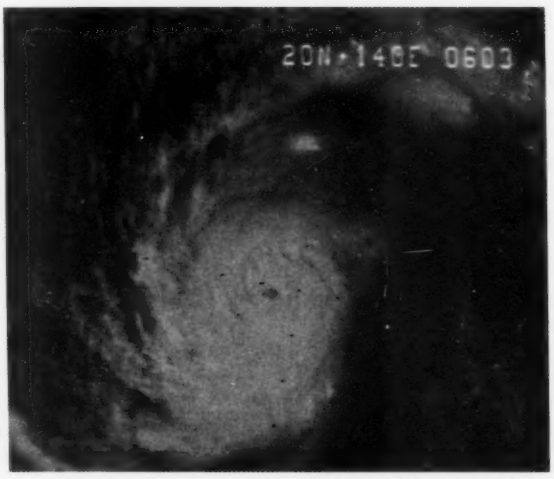
November—The Aleutian Low at 996 mb was about 6 mb deeper than normal while the subtropical high with definable centers in the mid Pacific and over northern California was 4 to 6 mb stronger than normal. This combination usually spells trouble because of tight pressure gradients between the high and low pressure areas, which indicate strong winds even on a climatic chart. Typhoons Dan and Elsie were plaguing the western North Pacific as the month opened.

A Low over Hokkaido on the 1st created the first weather for shipping along the northern routes in November. Moving east northeastward, it developed slowly at first but from 1200 on the 2nd to 1200 on the 3rd as it moved along the Aleutians, central pressure fell 34 mb down to 960 mb. Winds of 40 to 50 kn were reported along with swells in the 10- to 20-ft range. At 1200 the KHRK (46°N, 175°E) measured 55-kn westerlies in 13-ft seas while 6 hrs later the ***Sea Bells*** in the same vicinity hit 55-kn winds in 25-ft seas. The storm dipped toward the east southeast on the 4th but then started to fill as it turned northward into the gulf of Alaska.

On the 5th Elsie became a super typhoon near 17°N, 137°E.

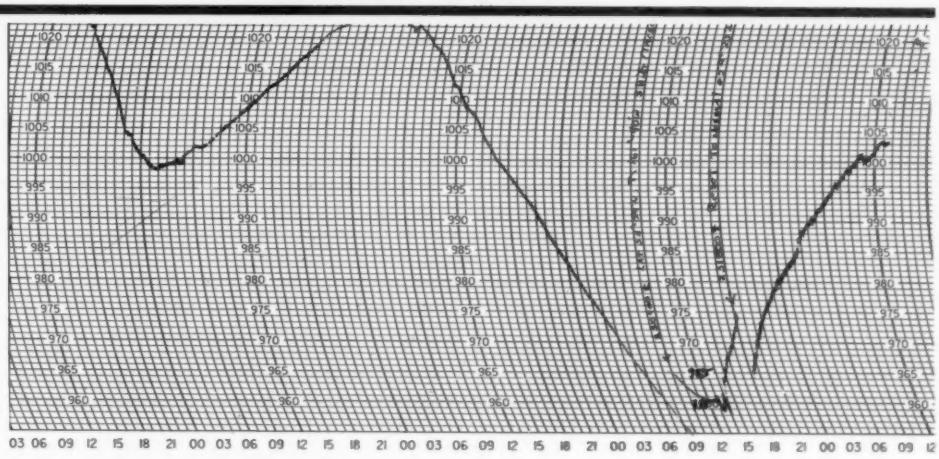
Several potent storms moved through the Bering Sea over the week of the 7th through the 14th. On the 8th a 968-mb Low was centered near 60°N, 180°. It had generated some gale force winds over the northern shipping lanes the previous day and continued to cause some problems on the 8th and 9th. This storm was followed by an even more potent system on the 12th, when a 960-mb center was spotted near 56°N, 170°E. At 1200 the 3EJX ((51°N, 175°W) hit 50-kn south southwesterlies in 8-ft seas. Southwest of the center the swells were running 15 to 25 ft. This storm turned a counterclockwise loop, but in the process it weakened on the 14th. To the south Typhoon Hunt was developing and would soon create problems in Alaskan waters. After a week of relatively moderate activity, a short-lived system flared up briefly off Vancouver Is on the 21st. Its pressure dipped to 978 mb before it moved harmlessly ashore the following day. However, during that brief flare up on the 21st coastal shipping from Southern California to Washington reported winds in the 40- to 50-kn range with 10- to 15-ft seas. Typical of the observations was that of the WRYC (45°N, 134°W) at 0000 on the 21st which measured 45-kn southwesterlies in 17-ft seas.

Monster of the Month— About this time Typhoon Hunt had recurved toward the northwest and was



Sattelite Data Services Division

Typhoon Elsie became a super typhoon shortly after this photograph was taken at about 0600 on the 4th.



*The **President Jackson** was enroute to Yokohama from Oakland when it ran into the November Monster of the Month on the 23rd. At 1800 on the 23rd, the **President Jackson** ran into a 70-kn north northwesterly and had sustained storm force winds for several hours.*

undergoing an extratropical transformation. By 1200 on the 22nd, its 986-mb extratropical center had crossed the 45th parallel near 170°E. During the next 24 hrs, its pressure dropped 38 mb to 948 mb and it was over the Alaska Peninsula, while its circulation was affecting the northern shipping lanes

mostly east of the Dateline.

At 1200 on the 23rd, the ***Sea-Land Pacific*** (48°N, 177°E) encountered 45-kn winds in 23-ft swells– that's some 600 mi southwest of the center. Closer to home ships were getting clobbered as well. The ELND4 (52°N, 176°W) at 1200 measured 51-kn northwesterlies and nearby the DQFW estimated winds at 60 kn. At 1800 on the 23rd, the ***Virginia*** (54°N, 160°W) and the ***Sea Bells*** (54°N, 161°W) both recorded a pressure of 950 mb. The ***Sea Bells*** was in 20-ft seas. The WRYC (54°N, 166°W) hit a 70-kn northerly in 25-ft seas with a 963-mb reading at 1800. The OOCL ***Executive*** (50°N, 167°W) at 2100 measured a 52-kn northwesterly in 25-ft swells. The battering continued into the 24th as the monster made its way into the Gulf of Alaska. Winds of 40 to 60 kn were common as were seas of 20 to 30 ft and several vessels reported pressure in the 955- to 965-mb range. Most of the action was south of the Alaska Peninsula. At 0600 on the 24th, the 3EPB6 measured 50-kn winds in 26-ft swells with a 953-mb reading near 54°n, 159°W. The pounding continued throughout the day, but there was a noticeable improvement on the 25th as the central pressure rose to 977 mb. The storm finally petered out on the 27th.

This was not the final blow of the month as another system intensified in the Aleutians on the 27th. Its central pressure dipped to 952 mb and it began to disrupt shipping over the northern routes. By 0000 on the 28th, a 944-mb center was located near 56°N, 180. The ELAV2 (53°N, 179°W) measured a 970-mb pressure in 54-kn westerlies and 26-ft seas on the 28th and 29th as the storm made its way across the southeastern Bering Sea and onto Alaska south of Bethel.

Casualties– During Typhoon Elsie 4,000 tree trunks spilled into the Pacific about 180 mi east of Tokyo from the bulk carrier ***Lucy Oldendorff*** on the 8th. The container vessel ***Nordkap*** due on the 17th at Kasohsuing reported heavy weather damage on its passage from Indonesia–Hong Kong–Taiwan. The fish factory Sea Alaska and barges ***Jan B***, ***Empress Hilton***, and ***Neptune*** all reported heavy weather damage sustained at Akutan, AK on the 23rd. Six Japanese sailors were missing on the 24th after the ***Shosen Maru*** No. 8 capsized in rough waters off Hokkaido. Patrol aircraft found the vessel overturned and a lifeboat nearby but no signs of a crew. The vessel had left Rishiri Is on the 23rd with 5 tons of fish despite warnings of stormy weather. On the 18th the American deck barge ***Francisca*** broke tow 15 mi north northeast of Guam during Typhoon Hunt. The bulk carrier NL Trader sustained heavy weather damage on the 25th while in ballast passage from Kwangyang to British Columbia.

December– The big weather story of the month was the dominance of the subtropical high, reminiscent of midsummer conditions over the North Pacific. A number of 1036 mb Highs throughout the month, particularly in the second half, were responsible for the climatic aberation. The result was anomalies of up to 12 mb south of the Alaska Peninsula and positive anomalies distributed all across the North Pacific Basin. The Aleutian Low was weaker than normal and forced out of the Gulf of Alaska.

The month opened with a 952-mb Low over the central Aleutians heading north northeastward. It remained around long enough to harass shipping over the northern routes for the first 2 days of the month. At 0000 on the 1st the ***Neptune Crystal*** (41°N, 174°W) was blasted by 56-kn winds, and this was confirmed by the KIRH nearby with 54-kn southerlies. Most wind reports were in the 40- to 50-kn range with swells of 10 to 17 ft. At 0000 on the 2nd, the ***Sea-Land Explorer*** (53°N, 158°W) measured 48-kn southerlies in 25-ft swells as the storm headed for Norton Sound and began to fill.

However, the previous storm was replaced by another system on the 3rd which, after forming south of Tokyo on the 2nd, moved northeastward to the central Aleutians the following day. By the 4th at 1200, the storm had turned eastward and its central pressure was 968 mb. The system generated 40- to 55-kn winds with swells reaching 30 ft in some areas. At 0600 on the 4th, the ***Emma Oldendorff*** (43°N, 178°W) measured 57-kn westerlies in 35-ft swells, while nearby the ***Esperance*** ran into 55-kn winds in 26-ft swells. This storm moved into the Gulf of Alaska on the 5th as a 968-mb Low but filled rather quickly during the next 24 hr.

From the 7th through the 9th, the weather over the eastern North Pacific and Gulf of Alaska was dominated by a large Low which dropped to 966 mb at its peak on the 8th. This system was a 980-mb Low as it crossed the 45th parallel near the Dateline on the 6th. It intensified and headed east northeastward and finally northward on the 8th, near 140°W. In general, the storm generated winds in the 40- to 45-kn range with seas up to 15 ft.

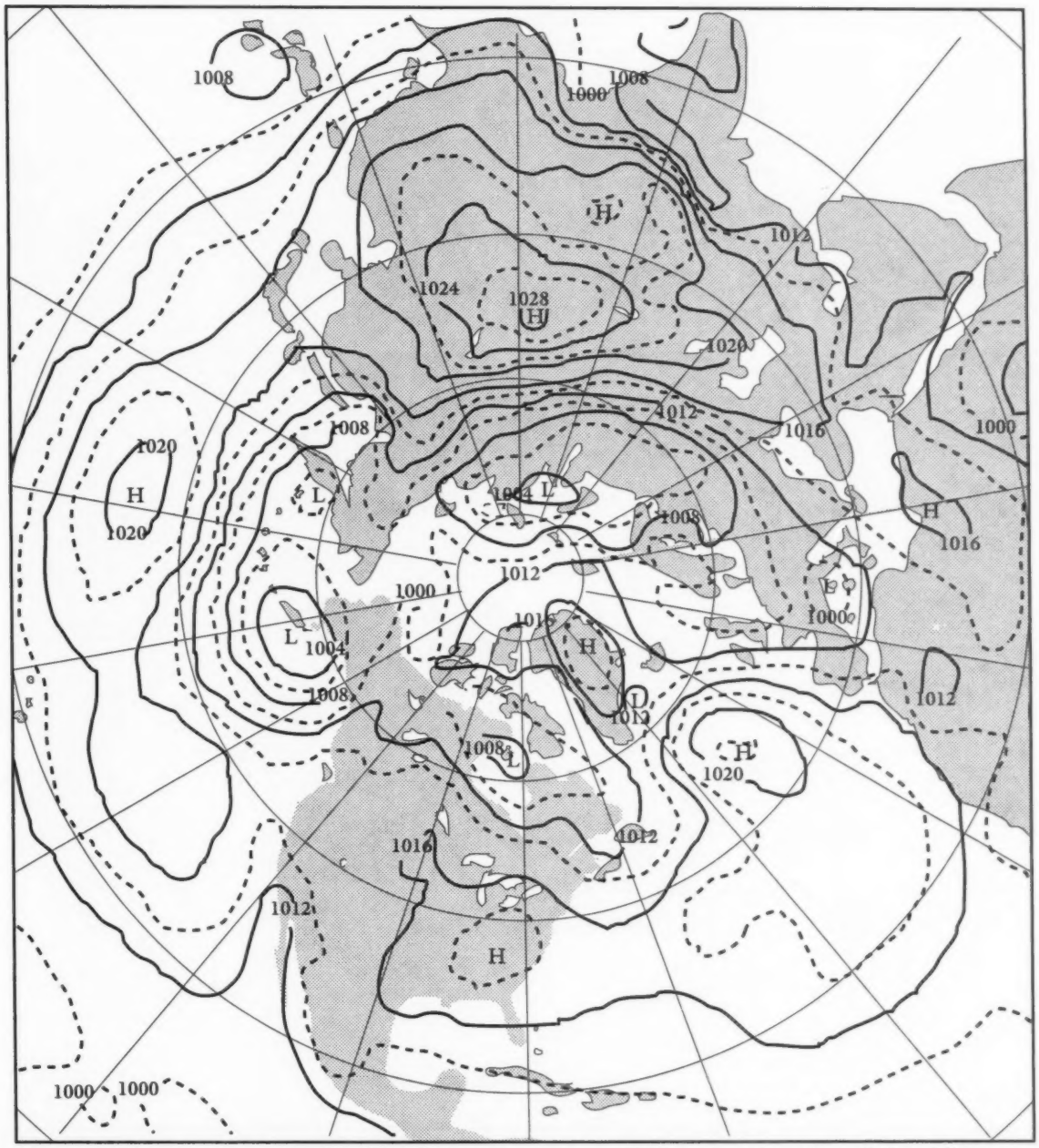
The next big Gulf of Alaska storm came to a head on the 13th when a 968-mb Low at 1200 on the 12th moved northeastward into the Gulf and dropped 20 mb in 24 hrs. The 948-mb center was analyzed near 55°N, 150°W at 1200 on the 13th. The best report was from the KHJB (58°N, 150°W) at 1300 on the 13th, when they measured 56-kn east northeasterlies, a 976-mb pressure and 20-ft swells. Two hours later the ***Great Land*** (54°N, 134°W) hit 54-kn southerlies in 15-ft seas and the buoy 46003 (52°N, 156°W) measured 41-kn winds in 35-ft seas. This was a rough storm. Fortunately, it began to break up rather quickly on the 14th.

The Highs began to take over and much of the cyclonic action was confined to the western North Pacific during the second half of the month. The severest storm during this period flared up briefly on the 21st when a north northeastward moving Low dropped to 960 mb at 1200 near 50°N, 175°E. Most of the activity was to the south of the center where winds were blowing between 40 and 50 kn in conjunction with the development of a secondary center. In fact, on the 22nd several vessels between 33° and 38°N near 169°E got caught by 50-kn winds. Meanwhile, the original Low remained potent as testified to by the ***Shintonami*** on the 22nd at 0000 near 53°N, 169°E which ran into a 48-kn north northeasterly in 33-ft swells. By the 23rd the secondary storm moved north northeastward and took over as its 978-mb center crossed the 50th parallel near the Dateline.

Several more storm systems developed during the remainder of the month in the vicinity of the Kamchatka Peninsula but none was particularly severe. Toward the end of the month a 980-mb Low did come to life off the coast of Washington and created a few problems for coastal shipping but all in all things were relatively peaceful in the eastern North Pacific during the last week of the year.

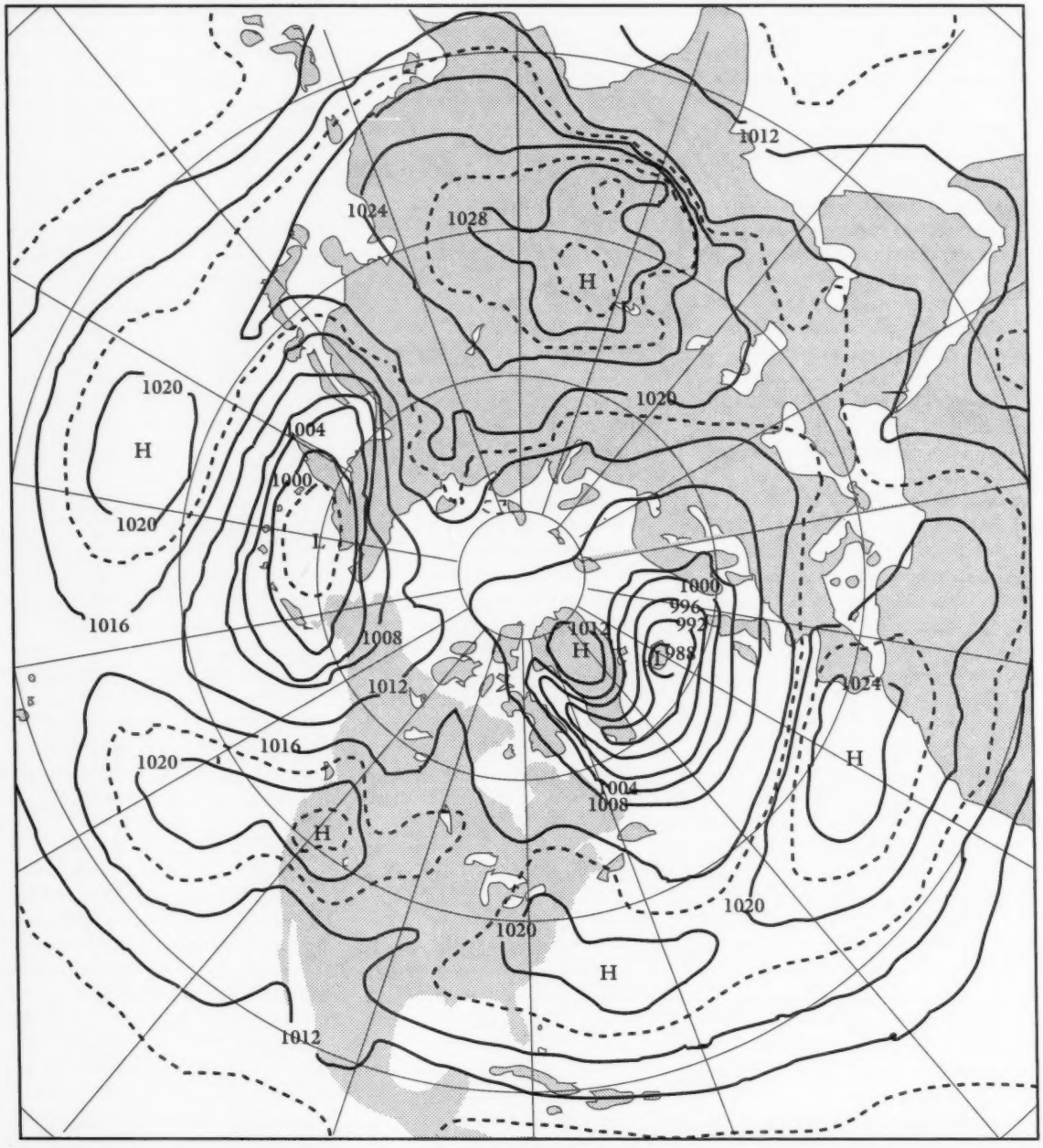
Casualties– The USCGC ***Boutwell*** was on Alaska patrol on the 13th and they were battling 30-ft seas when a "freak" wave estimated at more than 40 ft crested and broke over the ship, staving in a water tight door and causing other minor damage. The bulk carrier ***Vitali II*** reported heavy weather damage between the 2nd and the 9th. In rough seas the passenger ferry ***Fomeni Wini I*** collided with the cargo ship ***Melina II*** some 2.5 mi off Gresik harbor, eastern Jawa on the 26th. The ferry sank immediately, sending passengers jumping into the sea. Of the 49 passengers and crew one died and 10 were injured. The sand carrier ***Nakafuku Maru*** bound for Kawasaki capsized in strong winds off Tokyo Bay on the 23rd. One crewman died and the master was missing. The mv ***Siau*** sank on the 19th in near gale-force winds and rough seas near 20.9°N, 116.3°E. The 22-member crew were rescued.

October 1992



These Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin

November 1992



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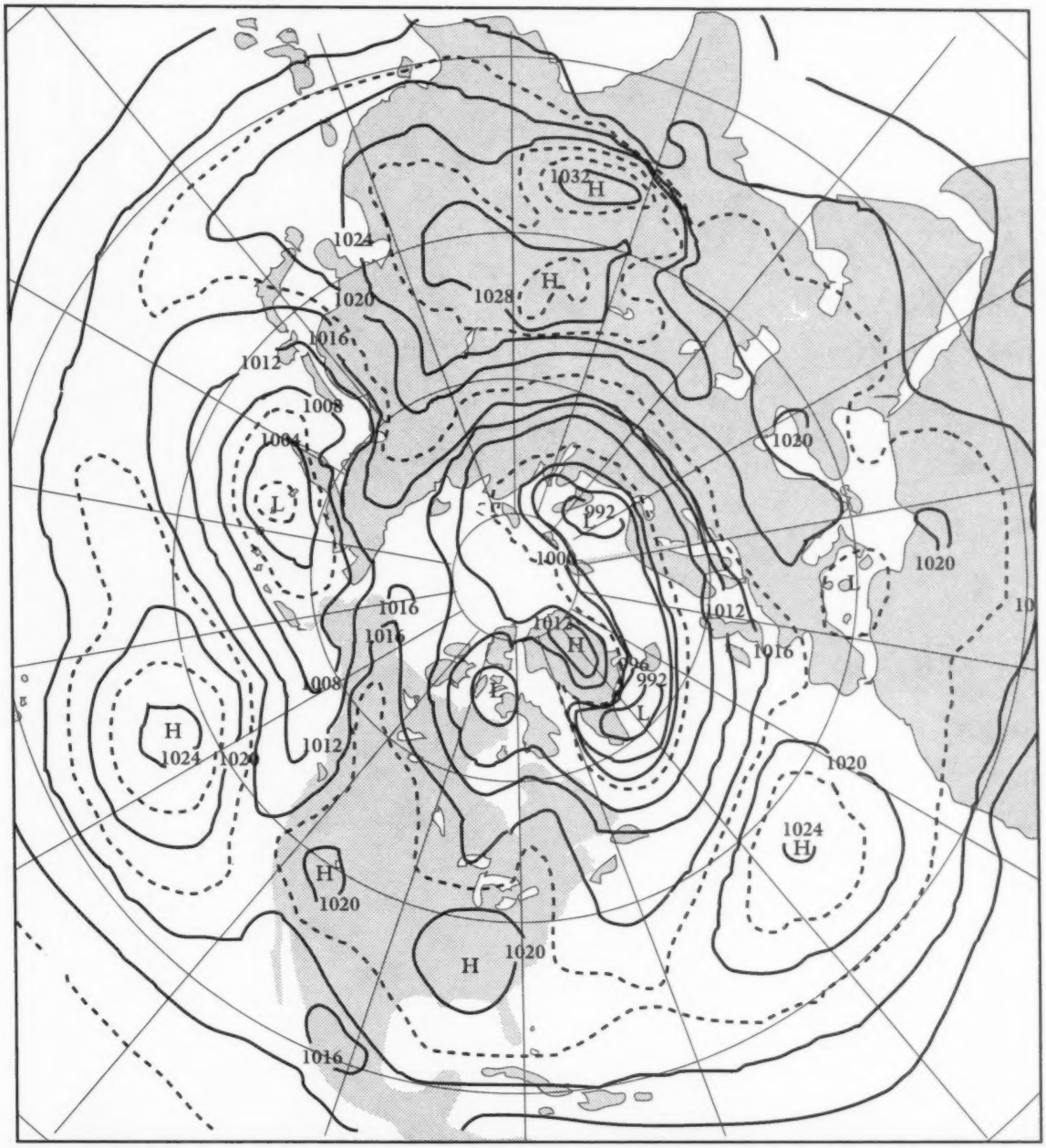

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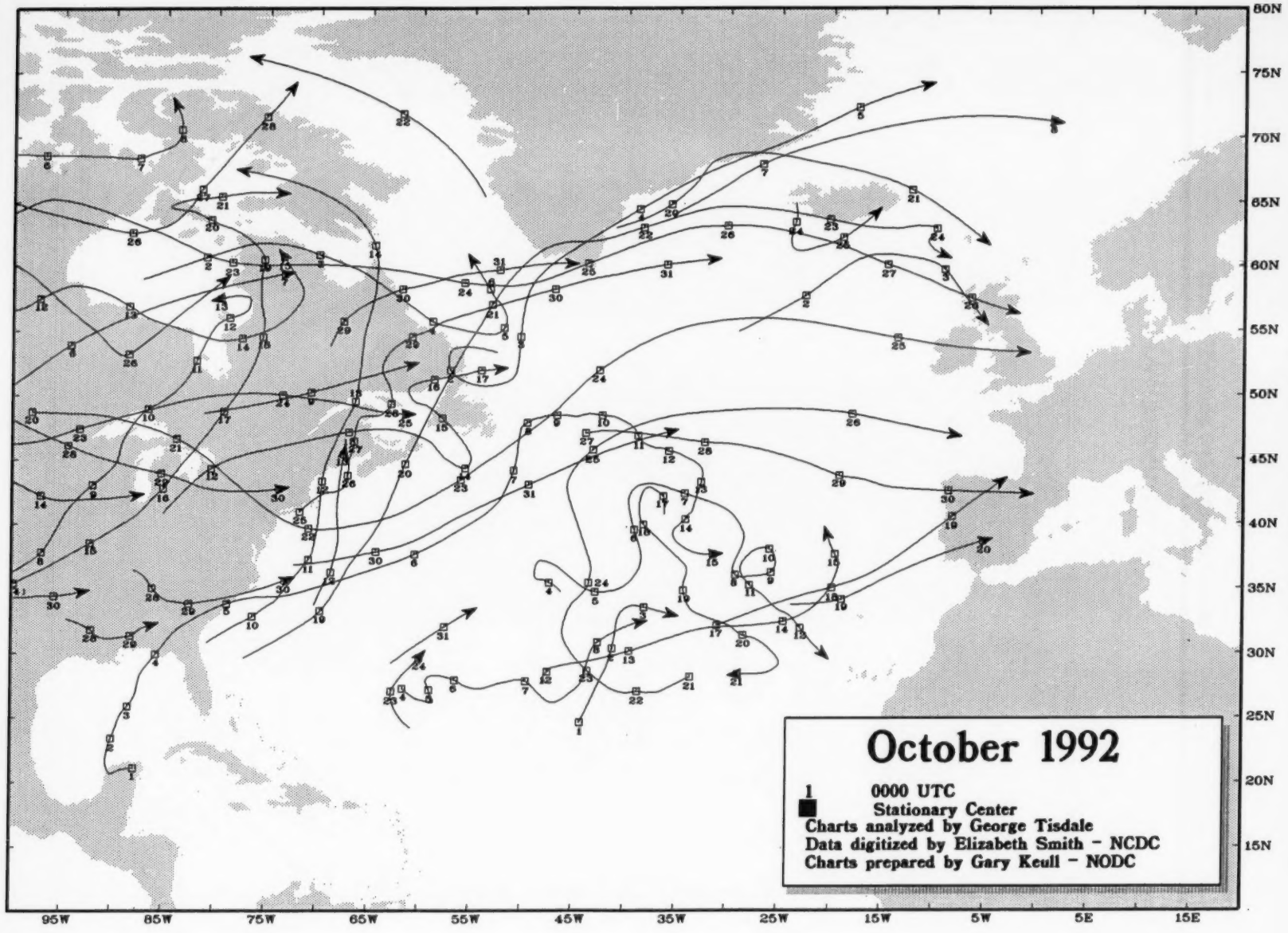
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



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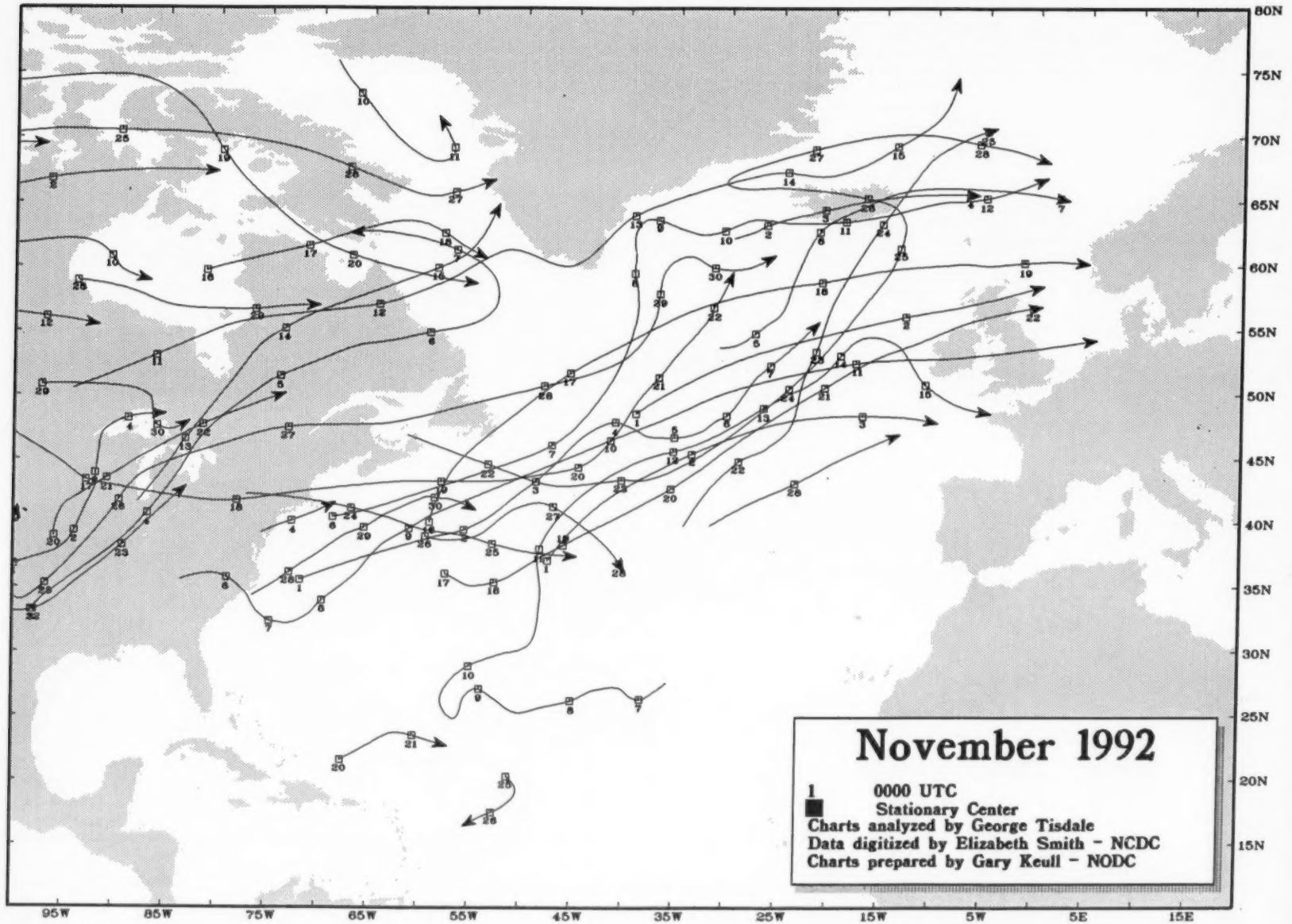
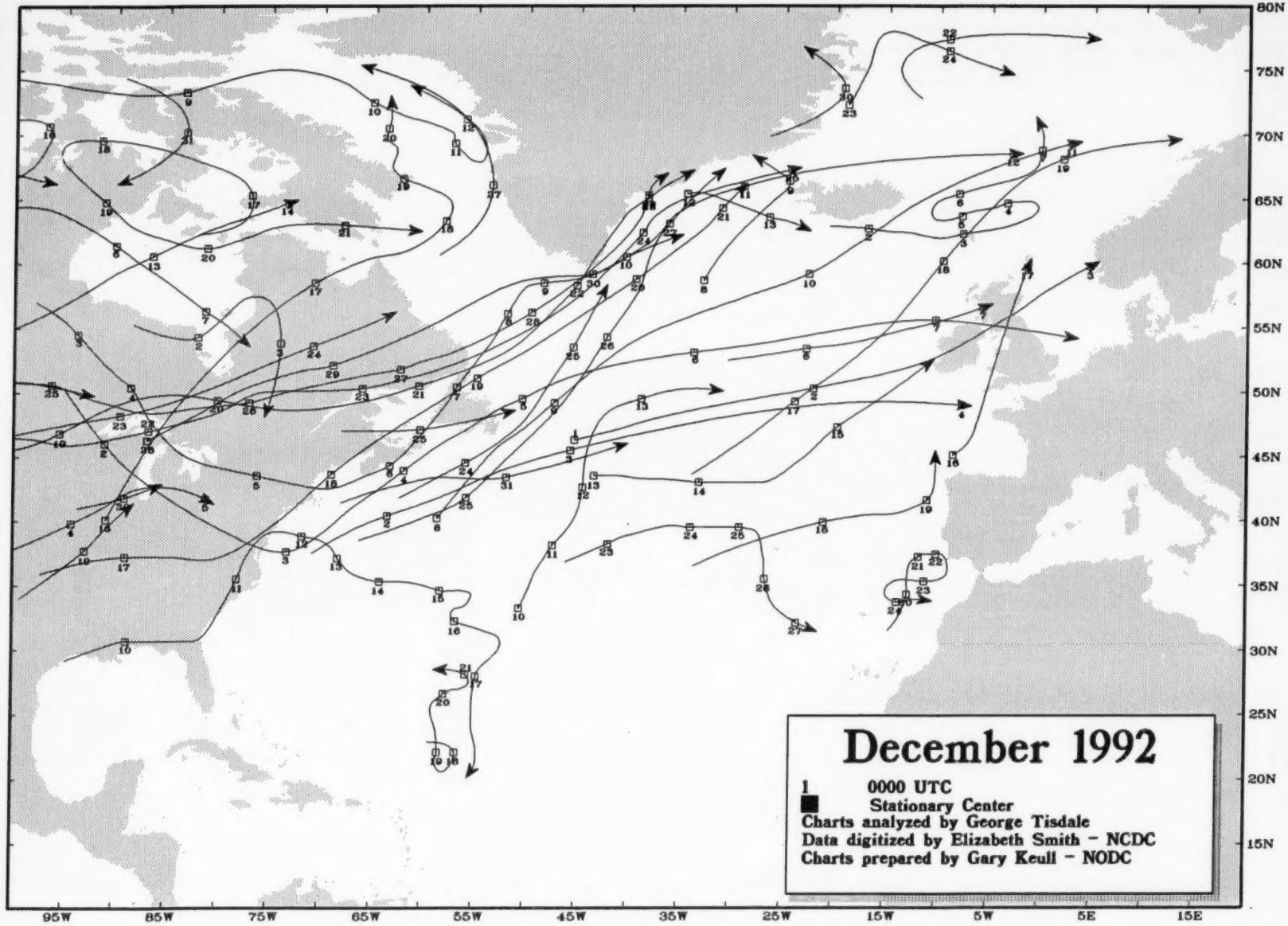
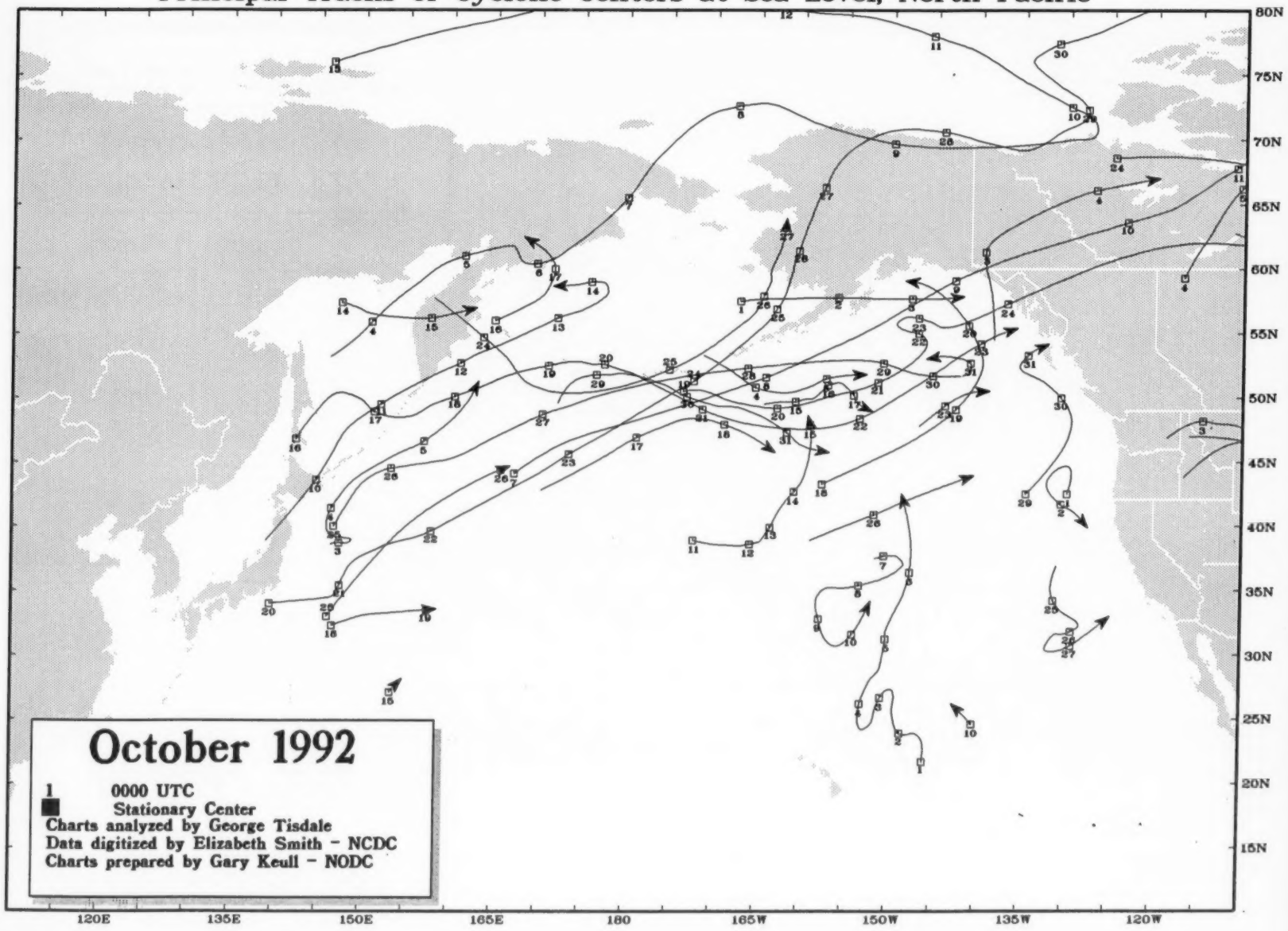


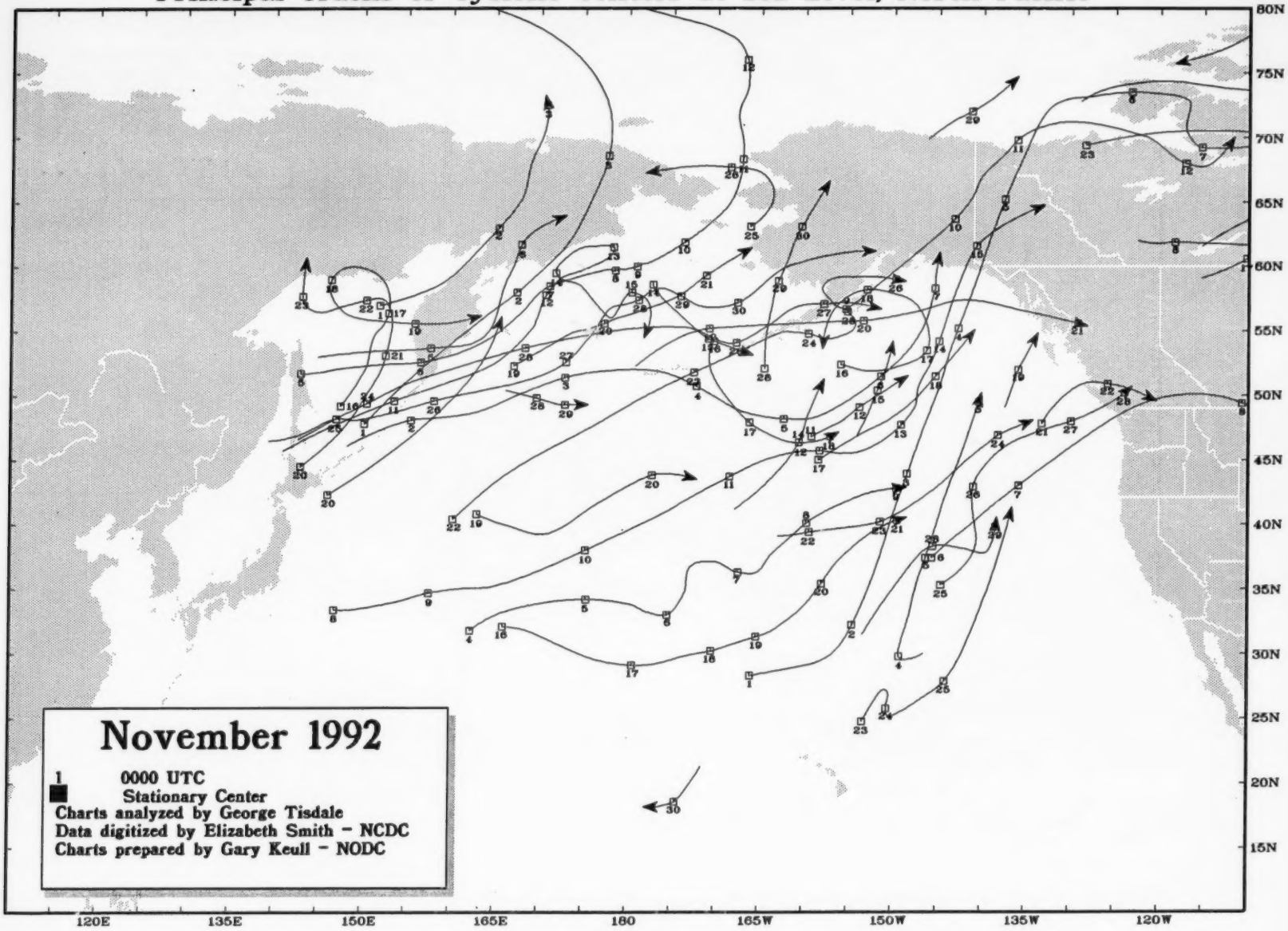
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



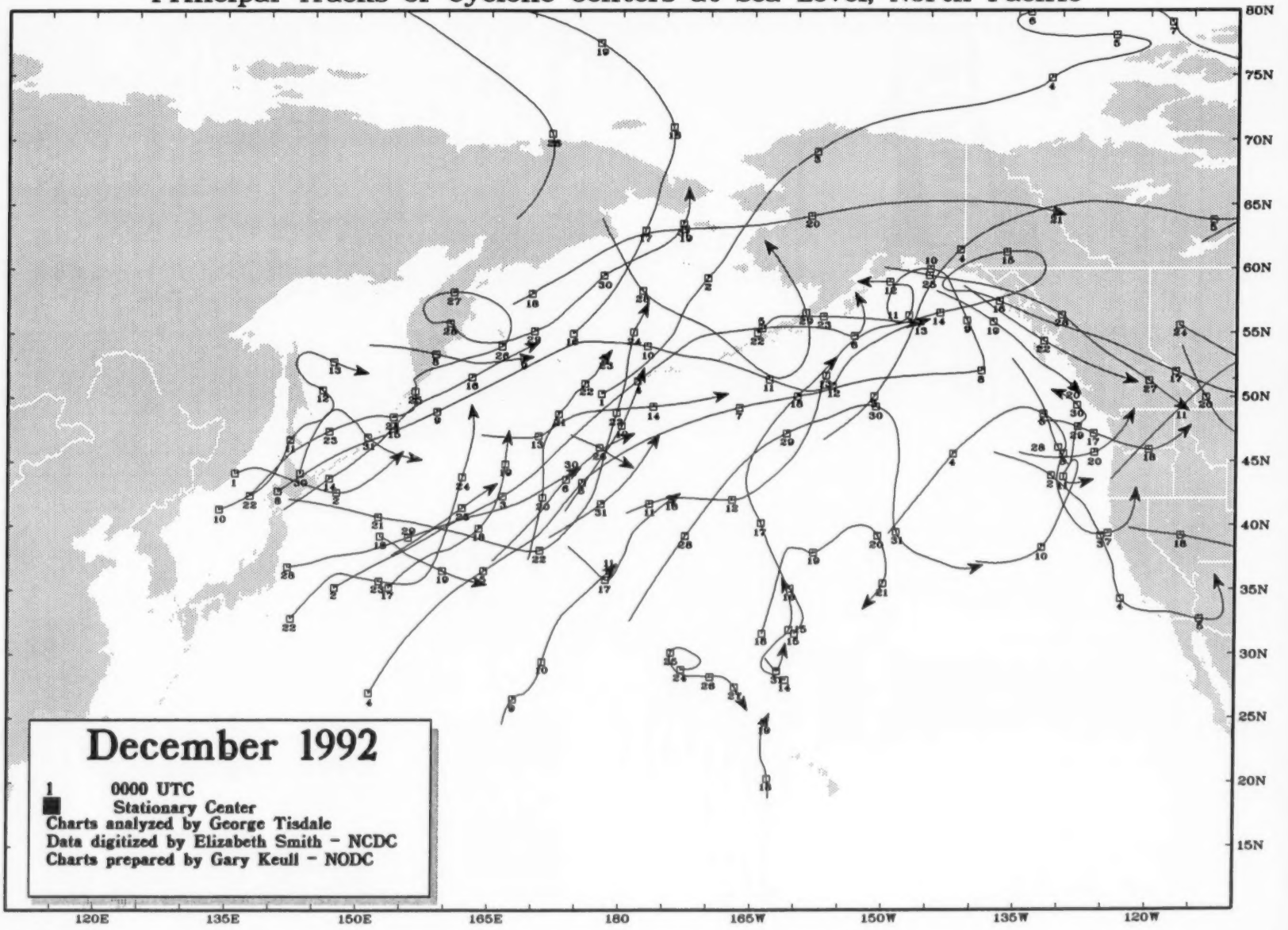
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



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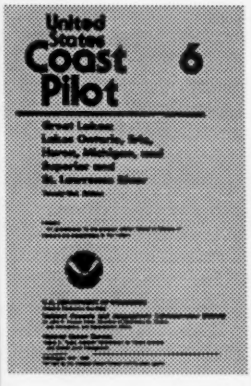

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Over 70 reports describing principal U. S. coastal, Great Lakes, and inland ports are available. Each volume details waterfront facilities for one or more ports. They are accompanied by large aerial photographs showing the locations of the facilities, and each volume is periodically revised to keep information current. The volumes are individually priced and advance payment is required. They are a valuable addition to the library of the navigator, marine planner, or anyone interested in an in-depth look at the nation's ports. For a complete list of the Port Series Reports write:

Water Resources Support Center
(CEWRC-NDC-P)
Casey Building
Fort Belvoir, VA 22060-5586

October, November and December 1992

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RECIFE	46	
RED ARROW		35
REFORM	40	
RESERVE	34	45
RESOLUTE	40	97
RICHARD G MATTIESEN	16	
RICHARD REISS	10	17
RIO NEGRO II	1	
RISANGER	39	
RIVERHEAD SPIRIT	6	
ROBERT E. LEE	34	36
ROSETTA	77	24
ROTTERDAM	124	
ROVER	32	165
ROWANBANK	18	
ROYAL PRINCESS	70	
RUBIN DOGA	39	
RUBIN OCEAN	72	50
RUTH LYKES	54	50
S.T. CRAPO	198	137
SALINA CRUZ PILOTS	284	151
SALINAS	23	62
SALUD ACE	26	25
SAM HOUSTON	29	
SAMUEL H. ARMACOST	3	
SAMUEL L. COBB	32	29
SAN MARCOS	113	159
SAN MARTIN	78	
SAN PEDRO	26	
SANGAY	7	
SANGHA	29	
SANKO LILY	25	20
SANKO PIONEER	36	
SANKO PRELUDE	52	193
SANTA BARBARA	39	
SANTA MONICA	25	
SANTOS	74	
SAPAI	5	
SATURN DIAMOND	22	
SAVANNAH	4	
SCARAB	81	
SCHACKENBORG	17	38
SEA BELLS	24	261
SEA FAN	66	165
SEA FORTUNE	32	97
SEA FOX	52	5
SEA ISLE	24	66
SEA LIGHT	30	25
SEA LION	89	150
SEA MERCHANT	214	84
SEA TRADE	26	171

	RADIO	MAIL
SEA WEALTH	65	152
SEA WOLF	177	43
SEAL ISLAND		6
SEALAND ACHIEVER	188	282
SEALAND ANCHORAGE	73	170
SEALAND ATLANTIC	76	96
SEALAND CHALLENGER	52	84
SEALAND CONSUMER	178	208
SEALAND CRUSADER	68	35
SEALAND DEFENDER	137	111
SEALAND DEVELOPER	75	120
SEALAND DISCOVERY	56	28
SEALAND ENDURANCE	60	130
SEALAND ENTERPRISE	200	257
SEALAND EXPEDITION	43	14
SEALAND EXPLORER	101	195
SEALAND EXPRESS	110	132
SEALAND HAWAII	211	254
SEALAND INNOVATOR	123	167
SEALAND INTEGRITY	210	248
SEALAND KODIAK	38	76
SEALAND LIBERATOR	88	164
SEALAND MARINER	50	54
SEALAND NAVIGATOR	235	212
SEALAND PACIFIC	170	194
SEALAND PATRIOT	64	99
SEALAND PERFORMANCE	47	141
SEALAND PRODUCER	101	96
SEALAND QUALITY	49	
SEALAND RELIANCE	97	210
SEALAND SPIRIT	57	198
SEALAND TACOMA	62	136
SEALAND TRADER	195	130
SEALAND VALUE	86	128
SEALAND VOYAGER	59	145
SEAWARD BAY	59	35
SEDCO/BP 471	309	207
SEMINOLE	16	55
SENATOR	27	
SGT WILLIAM A BUTTON	26	15
SGT. METEJ KOCAK	18	31
SHELDON LYKES	54	68
SHELLY BAY	78	31
SHIRAOI MARU	157	57
SHOSHONE SPIRIT	80	103
SIDNEY STAR	178	
SINCERE SUCCESS	27	30
SKANDERBORG	64	58
SKAUBRYN	191	
SKAUGRAN	134	167
SKODSBORG	16	
SOLAR WING	78	
SONORA	54	83
SOUTHLAND STAR	166	
SPRING BEAR	101	
ST BLAIZE	60	
ST. CLAIR	136	141
STAFFORDSHIRE	155	
STAR ALABAMA	32	86
STAR AMERICA	29	
STAR DRIVANGER	95	
STAR EAGLE	84	110
STAR EVVIVA	31	18
STAR FLORIDA	92	
STAR FRASER	72	
STAR FUJI	18	
STAR GEIRANGER	7	
STAR GRAN	104	130
STAR GRINDANGER	36	
STAR LIVORNO	1	
STAR MASSACHUSETTS	14	
STAR MERCHANT	30	50
STAR STRONEN	16	
STAR WESTCHESTER	41	
STAR WILMINGTON	57	
STELLA LYKES	14	18
STELLAR BENY	1	
STEWART J. CORT	411	442
STONEWALL JACKSON	17	26
STRIDER ISIS	27	72
STRIDER JUNO	178	
STRONG VIRGINIAN	21	
SUE LYKES	57	30
SUGAR ISLANDER	3	
SUNBELT DIXIE	120	76
SUNRISE RUBY	33	30
SWIFTNES	24	
SYNNOVE KNUSTEN	18	16
TABASCO	105	83
TAI CHUNG	151	62
TAI HE	116	
TAI SHAN HAI	116	
TAI SHING	21	77
TAMPA	30	
TAMPA BAY	66	15
TERNOZA	3	
TEXAS SUN		11
THEKWINI	101	113
THOMAS G. THOMPSON	83	41
THOMPSON LYKES	59	
THOMPSON PASS		34
TILLIE LYKES	51	113
TOBA	7	
TOHBEI MARU	1	
TOLUCA	125	42
TONCI TOPIC	13	
TONSINA	44	95
TORM FREYA		81
TORRENS	23	
TOWER BRIDGE	40	
TRANSWORLD BRIDGE	134	52
TRITON	234	266
TROLL FOREST	34	
TROPIC SUN	1	
TROPICAL BEAUTY		55
TROPICALE	24	9
TSL BOLD	66	38
TULSIDAS	42	
TYSON LYKES	34	93
UCHOA	75	214
ULLSWATER	268	
ULTRAMAX	11	
ULTRASEA	66	130
UNAMONTE	54	48
UNIVERSE	25	
URTE	1	
USCGC ACACIA (WLB406)	24	36
USCGC ACTIVE WMEC 618	15	
USCGC ACUSHNET WMEC 16	44	
USCGC ALERT (WMEC 630)	40	
USCGC BASSWOOD (WLB 38	22	
USCGC BEAR (WEMC 901)	71	
USCGC BISCAYNE BAY	5	16
USCGC BOUTWELL WHEC 71	60	
USCGC BRAMBLE (WLB 392	17	
USCGC CAMPBELL	21	
USCGC CHASE (WHEC 718)	21	
USCGC CITRUS (WMEC 300	49	
USCGC COURAGEOUS	5	63
USCGC DEPENDABLE	40	
USCGC DURABLE (WMEC 62	4	
USCGC ESCAPE (WMEC 6)	52	23
USCGC FIREBUSH WLB 393	27	
USCGC FORWARD	13	
USCGC GALLATIN	31	
USCGC GALVESTON ISLAND	16	
USCGC HAMILTON WHEC 71	27	
USCGC HARRIET LANE	11	11
USCGC IRONWOOD (WLB 29	10	
USCGC JARVIS (WHEC 725	30	
USCGC KATMAI BAY	2	
USCGC LAUREL (WLB 291)	21	
USCGC LEGARE		60
USCGC MACKINAW	9	40
USCGC MALLOW (WLB 396)	23	
USCGC MELLON (WHEC 717	29	74
USCGC MIDGETT (WHEC 72	13	
USCGC MOHAWK WMEC 913	76	
USCGC MUNRO	135	
USCGC NORTHLAND WMEC 9	53	66
USCGC PLANETREE	6	
USCGC POLAR SEA__(WAGB	67	71
USCGC POLAR STAR (WAGB	250	40
USCGC RELIANCE WMEC 61	34	
USCGC RESOLUTE WMEC 62	13	
USCGC RUSH	124	20
USCGC SEDGE (WLB 402)	12	
USCGC SENECA	39	34
USCGC SPENCER	2	25
USCGC STORIS (WMEC 38)	86	106
USCGC SUNDEW (WLB 404)	28	35
USCGC SWEETBRIER WLB 4	8	
USCGC TAHOMA	44	
USCGC TAMAROA (WMEC 16	52	
USCGC TAMPA WMEC 902	11	6
USCGC VENTUROUS WMEC 6	21	
USCGC VIGILANT WMEC 61	3	
USNS ALGOL	28	
USNS ANTARES	5	
USNS APACHE (T-ATF 172	6	
USNS AUDACIOUS T-AGOS	74	
USNS BARTLETT(T-AGOR 1	42	
USNS BELLATRIX	16	27
USNS CAPELLA	13	23
USNS GUADALUPE		35
USNS GUS W. DARNELL	46	48
USNS HARKNESS (T-AGS 3	54	53
USNS JOHN MCDONNELL (T		155
USNS JOSHUA HUMPHREYS	12	
USNS KANAWHA T-AO 196		46
USNS KANE TAGS 27	13	
USNS LITTLEHALES (T-AG	1	
USNS MERCURY	62	
USNS MOHAWK (T-ATF 170	116	
USNS NAVAJO_(TATF-169)	112	
USNS POLLUX	7	16
USNS POTOMAC	21	
USNS POWHATAN TATF 166	12	
USNS REDSTONE	31	86
USNS SEALIFT ANTARCTIC	4	
USNS SEALIFT ARCTIC	22	
USNS SEALIFT ATLANTIC	199	229
USNS SEALIFT CARIBBEAN	5	
USNS SEALIFT CHINA SEA	3	
USNS SEALIFT INDIAN OC	4	18
USNS SEALIFT MEDITERRA	4	
USNS SEALIFT PACIFIC	1	30
USNS SILAS BENT T-AGS	76	
USNS SIOUX		68
USNS TENACIOUS	58	
USNS VANGUARD TAG 194	24	
USNS VICTORIOUS	142	
USNS WALTER S. DIEHL		18
USNS WILKES T-AGS-33	39	30
VERA ACORDE	5	
VINE	179	
VIRGINIA	99	407
VISHVA VIKRAM	5	
VIVA	80	172
WALCHAND	16	
WALTER J. MCCARTHY	151	184
WASHINGTON HIGHWAY	130	
WASHINGTON RAINBOW #2	85	121
WECOMA	222	258
WELLINGTON STAR	191	
WEST MOOR	155	
WESTERN FUTURE	25	
WESTWARD	111	93
WESTWARD VENTURE	96	129
WESTWOOD ANETTE	69	38
WESTWOOD BELINDA	28	
WESTWOOD CLEO	101	127
WESTWOOD JAGO	111	137
WESTWOOD MARIANNE	50	198
WILFRED SYKES	116	66
WILLIAM E. MUSSMAN	35	142
WILLIAM R. ROESCH	66	87
WOLVERINE	83	94
WORLD WING #2	66	64
YANKEE CLIPPER	19	
YOKOHAMA	26	6
YOUNG SPROUT	88	84
ZAGREB EXPRESS	21	
ZETLAND	204	
ZIM AMERICA	80	
ZIM CANADA	54	
ZIM HOUSTON	20	
ZIM IBERIA	32	
ZIM KEELUNG	113	
ZIM KINGSTON III	203	
ZIM MARSEILLES	25	
ZIM MIAMI	41	
ZIM SAVANNAH	39	

SUMMARY: GRAND TOTAL VIA RADIO 63226
GRAND TOTAL VIA MAIL 49560
TOTAL UNIQUE OBS 86117
TOTAL DUPLICATES 26669 (31.0%)
UNIQUE RADIO OBS.36557 (42.5%)
UNIQUE MAIL OBS. 22891 (26.6%)

Bathy-Tesac Data at NMC

October, November and December 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	23	23	0	PACDUCHESS
BOAB	53	53	0	TAI HE
CCVG	11	11	0	***
CGBS	19	19	0	PARIZEAU
CGDG	79	0	79	HUDSON
CGDK	50	50	0	E. E. PRINCE
CGDV	498	0	498	W. TEMPLEMAN
CG2676	25	0	25	SHAMOOK
CZDO	30	30	0	***
C6HL8	41	41	0	COLUMBIA STAR
C6IO	21	21	0	MANICHE
C6IO5	47	47	0	NATHALIE DELMAS
C6JY6	179	179	0	MELBOURNE STAR
C6JZ2	122	122	0	AMERICAN STAR
DAKE	91	91	0	KOELN ATLANTIC
DA9100	60	60	0	PLATFORM NORDSEE
DBBH	57	57	0	METEOR
DBFP	25	25	0	WALTHER HERWIG
DBLK	71	71	0	POLARSTERN
DD8436	12	12	0	FEHMARNBELT
DESI	24	24	0	VALDIVIA
DGLM	102	102	0	MONTE ROSA
DGVK	66	66	0	COLUMBUS VICTORIA
DGZV	66	66	0	COLUMBUS VIRGINIA
DHCW	82	82	0	COLUMBUS WELLINGTON
DIDA	73	73	0	ARIANA
DLEZ	15	15	0	YANKEE CLIPPER
D5BC	45	45	0	SEDCO BP/471
D5NE	68	68	0	MT CABRITE
D5NZ	121	121	0	POLYNESIA
ELAX2	5	5	0	MICRONESIAN PRIDE
ELBX3	28	28	0	PACKING
ELEH4	42	42	0	C R POINTE NOIRE
ELHL6	104	104	0	COLUMBUS OHIO
ELIL9	135	135	0	NAVIGATOR
ELIS	12	12	0	MARINER
ELIS8	88	88	0	MARINER
EREC	93	14	79	PRILIV
EREU	22	16	6	ERNST KRENKEL
FHZI	20	20	0	L'ASTROLABE
FITA	53	53	0	NOROIT
FNCZ	73	73	0	DELMAS SURCOUF
FNDK	22	22	0	PATRICIA DELMAS
FNGS	89	89	0	LA FAYETTE
FNJT	4	4	0	KORRIGAN
FNOM	19	19	0	RENOIR
FNQB	15	15	0	ILE MAURICE
FNQC	17	17	0	VILLE DE ROUEN
FNQM	48	48	0	SUZANNE DELMAS
FNXW	6	6	0	SAINT ROCH
FNZO	154	154	0	RABELAIS
FNZP	30	30	0	RACINE
FNZQ	39	39	0	RIMBAUD
FPYO	1	1	0	CAP SAINT PAUL
GACA	59	59	0	CUMULUS
GLNE	6	6	0	DISCOVERY
GPDS	1	1	0	***
GQEK	55	55	0	FORTHBANK
GYRW	65	65	0	ENCOUNTER BAY
GYSA	42	42	0	FLINDERS BAY
GYSE	88	88	0	NEDLLOYD TASMAN
HPAN	15	15	0	MICRONESIAN COM-
MERCE				
HPEW	152	152	0	PACIFIC ISLANDER
H9BQ	24	24	0	MICRONESIAN INDE-
PENDENCE				
JBOA	102	102	0	KEIFU MARU
JCCX	70	70	0	CHOFU MARU
JCOD	10	10	0	SHOYO
JDRD	11	11	0	SHOYO MARU
JDWX	98	98	0	KOFU MARU
JFDG	37	37	0	SHUMPU MARU
JFPQ	102	102	0	KASHIMASAN MARU
JGZK	40	40	0	RYOFU MARU
JITV	131	131	0	WELLINGTON MARU
JKCF	89	89	0	GEORGE WASHINGTON BRID
JNZL	115	115	0	KAIYO MARU
JPVB	15	15	0	SEIFU MARU
JRBM	3	3	0	OGASAWARA MARU
JSVY	6	6	0	SHIRASE
J8GG4	36	36	0	HORIZON
KGJB	50	50	0	SEALAND DEFENDER
KIRH	84	84	0	SEALAND TRADER
KNBD	3	3	0	DELAWARE II
KNFG	71	71	0	SEA WOLF
KRGB	55	55	0	SEALAND ENTERPRISE
LADB2	18	18	0	SKAUGRAN
LAJV4	90	90	0	SKAUBRYN
LOFA	11	0	11	***
NAVOCE	145	145	0	U.S. NAVAL OCEANOGRAPHIC
NBTM	60	60	0	POLAR STAR
NFBS	1	1	0	STUMP
NIKA	44	44	0	SEALIFT ATLANTIC
NJST	1	1	0	THACH
NKID	2	2	0	KIDD
NNJB	5	5	0	***
NRNU	1	1	0	***
NRUO	12	12	0	POLAR SEA
NSCN	1	1	0	***
NTRI	3	3	0	WILKES
NUKJ	10	10	0	STERETT
NVIC	4	4	0	***
OWUO6	63	63	0	MOANA PACIFIC
PGEC	69	69	0	NEDLLOYD VAN NOORT
PGFE	35	35	0	NEDLLOYD VAN DIEMEN
PJJU	62	62	0	OLEANDER
SCOU	1	1	0	TV 243
SCPI	1	1	0	TV 258
SCPL	1	1	0	***
SCRIPP	1	1	0	SCRIPPS INST.
SEXN	4	4	0	TV 227
SEYD	3	3	0	TV 274
SHIP	700	700	0	***
SHPF	1	1	0	TV 281
SJIB	1	1	0	TV 282
SKVP	7	7	0	TV 284
SMZQ	2	2	0	TV102
S6FK	172	172	0	SWAN REEFER
TFEA	25	25	0	BJARNI SAEMUNDSSON
TFUD	6	6	0	BRUARFOSS
TUMG	6	6	0	GRAND BASSAM
UFYN	85	0	85	KAPITAN SHAYTANOV
UINF	9	9	0	VLADIMIR PARSHIN
UUPB	74	0	74	AKADEMIK N. SHOKALSKIY
UVMJ	1	1	0	VSEVOLOD BERYOZKIN
VC9450	196	0	196	GADUS ATLANTICA
VJBQ	79	79	0	ANRO AUSTRALIA
VJDI	37	37	0	IRON NEWCASTLE
VJDP	152	152	0	IRON PACIFIC
VKCN	69	69	0	CANBERRA
VKLA	11	11	0	ADELAIDE
VKLB	17	17	0	HOBART
VKLP	92	92	0	***
VKML	115	115	0	SYDNEY
VKPT	5	5	0	PERTH
VLNB	16	16	0	TORRENS

Bathy–Tesac Data at NMC

October, November, and December 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VP06	23	23	0	AIRCRAFT SQUADRON
VSBI3	64	64	0	BIBI
VXN8	565	565	0	AIRCRAFT
WCGN	33	33	0	CHEVRON CALIFORNIA
WECB	26	26	0	MELVILLE
WLDZ	2	2	0	MAURICE EWING
WPGK	103	103	0	SEALAND NAVIGATOR
WPKD	143	143	0	SEALAND ACHIEVER
WRBA	7	7	0	PACMISRANFAC HAWAREA
WRBB	5	5	0	PACIFIC MISSLE RANGE
WSRL	80	80	0	SEALAND PACIFIC
WTDK	40	40	0	D.S. JORDAN
WTDM	10	10	0	MILLER FREEMAN
WTDO	4	0	4	OREGON II
WTEA	6	6	0	DISCOVERER
WTEG	55	54	1	MOUNT MITCHELL
WTEJ	42	42	0	MCARTHUR
WTES	14	14	0	SURVEYOR
WWZZ	3	3	0	***
WXBR	9	9	0	CHEVRON MISSISSIPPI
YDLR	63	63	0	BOGASARI LIMA
Y3CW	17	0	17	A. V. HUMBOLDT
ZCAQ9	177	177	0	WEST MOOR
ZCKP	2	2	0	STAR DRIVANGER
ZCKU	60	60	0	STAR MAGNATE
ZDAZ	49	49	0	EXPLORER
ZDAZ6	77	77	0	EXPLORER
ZDBE9	83	83	0	VOYAGER
3DTF	203	203	0	SOUTHLAND STAR
3EAW7	39	39	0	ANDINO
3EET4	41	41	0	SEAS EIFFEL
7JOB	1	1	0	CALIFORNIA CERES
9VUU	49	49	0	ANRO ASIA
9VVB	90	90	0	GOLDENSARI INDAH
9VWM	37	37	0	MANDAMA
21002	708	708	0	BUOY
21004	727	727	0	BUOY
22001	719	719	0	BUOY
32315	67	67	0	BUOY
32316	13	13	0	BUOY
32317	13	13	0	BUOY
32318	13	13	0	BUOY
32319	107	107	0	BUOY
32320	18	18	0	BUOY
32321	18	18	0	BUOY
32322	15	15	0	BUOY
43001	18	18	0	BUOY
51006	28	28	0	BUOY
51009	31	31	0	BUOY
51010	16	16	0	BUOY
51011	2	2	0	BUOY
51014	15	15	0	BUOY
51015	12	12	0	BUOY
51016	1	1	0	BUOY
51017	20	20	0	BUOY
51018	35	35	0	BUOY
51019	51	51	0	BUOY
51020	28	28	0	BUOY
51021	15	15	0	BUOY
51110	1	1	0	BUOY
51301	54	54	0	BUOY
51302	16	16	0	BUOY
51303	14	14	0	BUOY
51304	38	38	0	BUOY
51305	25	25	0	BUOY
51306	16	16	0	BUOY
51307	41	41	0	BUOY
51308	45	45	0	BUOY
51309	23	23	0	BUOY
51310	28	28	0	BUOY
52001	11	11	0	BUOY
52002	13	13	0	BUOY
52003	40	40	0	BUOY
52006	14	14	0	BUOY
52007	40	40	0	BUOY
52010	15	15	0	BUOY
52011	13	13	0	BUOY
52012	14	14	0	BUOY
52301	22	22	0	BUOY
52302	16	16	0	BUOY
52303	57	57	0	BUOY
52304	28	28	0	BUOY
52305	44	44	0	BUOY
52307	44	44	0	BUOY
52308	17	17	0	BUOY

TOTAL BATHYS RECEIVED 11982
TOTAL TESACS RECEIVED 1075
TOTAL REPORTS RECEIVED 13057

July, August, and September 1992

Wave observations are taken each hour during a 20–minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one–third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0–minute averaging period each hour (moored buoys) and a 2.0–minute averaging period for fixed stations (C–MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688–2838 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
OCTOBER 1992													
32302	18.0S	085.1W	0721	17.6	18.3	2.4	4.6	12/07	14.3	SE	23.3	12/03	1016.7
41001	34.9N	073.0W	0738	20.9	23.9	1.9	6.4	05/19	13.7	SW	36.5	05/04	1017.0
41002	32.3N	075.2W	0735	22.5	25.2	1.8	5.3	06/04	12.7	NE	30.3	06/04	1016.9
41004	32.5N	079.1W	0741	21.7	25.1	1.3	4.3	04/16	13.1	N	29.7	05/20	1018.1
41006	29.3N	077.4W	0738	24.7	26.6	1.9	5.2	06/23	13.6	NE	25.1	01/03	1016.6
41009	28.5N	080.2W	1484	24.8	26.7	1.6	4.0	07/03	12.3	NE	28.0	07/01	1016.0
41010	28.9N	078.5W	1485	24.8	26.9	1.9	5.6	07/00	12.5	NE	28.0	06/23	1016.3
41016	24.6N	076.5W	0742	26.8	28.6	0.4	1.5	23/08	9.9	NE	27.2	23/08	1014.7
42001	25.9N	089.7W	0739	25.3	27.9	1.3	4.7	02/03	12.3	NE	33.4	02/03	1016.5
42002	25.9N	093.6W	0742	25.7	26.9	1.4	3.7	23/08	12.9	E	26.4	17/00	1016.3
42003	25.9N	085.9W	0744	25.7	27.4	1.2	4.2	02/11	12.4	E	31.7	02/05	1016.3
42007	30.1N	088.8W	0739	21.5	23.0				11.9	NE	29.0	03/05	1017.5
42019	27.9N	095.0W	0741	25.2	26.9	1.4	3.8	22/20	12.0	NE	23.7	08/13	1016.4
42020	27.0N	096.5W	0740	25.6	26.8	1.4	3.5	23/06	11.5	E	25.5	08/13	1016.1
44004	38.5N	070.7W	0738	16.5	19.5	1.8	4.8	05/18	13.3	W	29.5	05/07	1017.4
44005	42.6N	068.6W	0698	10.6	11.5	1.4	3.6	20/05	13.7	N	27.2	17/11	1015.4
44007	43.5N	070.1W	0733	9.3	10.9	0.7	2.2	20/04	11.8	N	26.6	25/15	1016.3
44008	40.5N	069.4W	0740	12.8	14.0	1.5	3.4	20/01	13.6	N	29.5	26/21	1016.0
44009	38.5N	074.7W	0643	14.9	17.4	1.1	3.8	05/10	14.4	N	33.0	19/18	1018.8
44011	41.1N	066.6W	0736	12.4	13.9	1.8	4.8	19/21	13.2	N	27.8	11/14	1016.6
44012	38.8N	074.6W	0738	14.4	17.0	1.0	3.2	05/09	13.7	SW	31.9	05/08	1018.0
44013	42.4N	070.8W	0740	10.7	11.8	0.6	2.8	20/06	12.2	W	26.8	17/05	1016.5
44014	36.6N	074.8W	0738	16.2	16.5	1.5	5.5	05/13	11.5	N	32.1	05/04	1017.8
44025	40.3N	073.2W	0715	13.9	15.6	1.1	2.4	05/13	12.5	NW	26.4	17/07	1017.5
45001	48.1N	087.8W	0740	5.1	5.6	0.8	3.9	16/17	11.6	NW	33.2	16/16	1015.7
45002	45.3N	086.4W	0739	9.7	12.8	1.0	3.2	16/21	14.1	S	34.6	16/21	1016.1
45003	45.3N	082.7W	0740	7.9	9.1	0.9	4.1	17/00	12.7	NW	33.2	16/20	1016.0
45004	47.5N	086.5W	0737	6.0	6.8	0.8	5.0	16/22	11.4	NW	33.4	16/20	1015.2
45005	41.7N	082.4W	0739	11.6	14.0	0.7	2.5	17/01	12.0	SW	31.9	17/00	1018.0
45006	47.3N	089.9W	0737	6.3	7.1	0.9	2.3	08/23	9.6	NE	22.0	12/07	1016.4
45007	42.8N	087.1W	0740	11.1	13.5	0.9	3.1	16/22	13.6	SW	30.1	09/08	1017.2
45008	44.3N	082.4W	0742	9.6	11.8	1.0	3.8	16/23	12.1	SW	31.4	16/20	1017.2
46001	56.3N	148.2W	0740	7.4	8.5	3.1	8.1	25/14	16.4	W	28.4	25/14	1002.7
46002	42.5N	130.3W	0736	16.1	17.3	2.8	7.0	01/12	14.3	N	29.5	01/14	1015.6
46003	51.9N	155.9W	0736	7.6	8.5	3.4	10.1	25/00	17.4	W	33.6	25/02	1003.0
46005	46.1N	131.0W	0736	14.6	16.0	2.9	6.3	30/18	14.0	SW	31.3	01/07	1014.2
46006	40.9N	137.5W	0736	17.0	18.1	3.1	8.1	30/09	13.9	S	32.1	29/17	1016.8
46011	34.9N	120.9W	0131		16.7	2.5	3.9	03/00	11.2	NW	18.7	04/01	1013.2
46012	37.4N	122.7W	0735	15.2	15.5	1.9	4.0	31/05	7.3	NW	24.9	29/16	1015.1
46013	38.2N	123.3W	0732	14.7	15.0	2.1	5.0	31/12	8.8	NW	25.6	14/00	1014.4
46014	39.2N	124.0W	0704	14.3	14.6	2.3	5.5	31/10	8.4	N	24.1	29/08	1014.7
46022	40.8N	124.5W	0740	13.1	12.9	2.2	5.1	31/15	8.6	N	29.7	29/11	1015.2
46023	34.3N	120.7W	0736	16.1	16.5	1.9	4.0	31/21	10.9	NW	22.0	22/06	1014.4
46025	33.8N	119.1W	0738	17.9	19.1	1.0	2.2	02/04	6.1	W	21.2	31/02	1014.1
46026	37.8N	122.7W	0689	15.0	15.1	1.4	3.3	31/05	7.9	W	30.3	29/15	1015.2
46027	41.8N	124.4W	0683	12.5	12.2	2.3	5.2	31/18					1014.9
46028	35.8N	121.9W	0737	16.0		2.1	4.5	31/21	9.4	NW	23.3	22/00	1015.1
46029	46.2N	124.2W	0734	13.0	12.8	2.2	4.9	31/03	11.4	S	27.4	29/16	1016.6
46030	40.4N	124.5W	0574	13.0	12.5	1.8	4.2	14/07	10.9	N	30.7	29/12	1014.7
46035	57.0N	177.7W	0738	4.6	6.3	2.9	6.9	01/05	17.4	E	37.3	05/07	1006.9
46041	47.4N	124.5W	0727	11.9	12.3	2.2	5.3	31/04	10.6	SE	30.3	29/18	1015.6
46042	36.8N	122.4W	0724	15.1		2.1	4.7	31/14	8.2	NW	26.2	29/17	1015.4
46045	33.8N	118.5W	0392	18.5	19.1				5.8	W	19.0	31/03	1014.2
46047	32.7N	119.6W	0742	17.9	19.6	1.9	3.8	03/04	11.6	NW	26.4	03/09	1014.9
46048	32.9N	117.9W	0734	19.1	20.6	1.1	2.4	31/15	7.6	NW	29.9	21/23	1013.7
46050	44.6N	124.5W	0734	12.6	12.3	2.3	5.6	31/04	11.9	N	27.8	31/15	1016.7
46051	34.5N	120.7W	0730	16.0	16.5	1.9	5.0	31/21	9.9	NW	19.6	23/16	1014.7
51001	23.4N	162.3W	0738	25.5	26.8	2.2	3.7	07/04	12.3	NE	23.8	07/12	1015.4
51002	17.2N	157.8W	0737	27.5	28.1	2.1	4.3	24/16	14.4	E	26.1	24/07	1013.1
51003	19.3N	160.8W	0741	26.7	27.8	2.2	3.7	26/13	11.6	E	20.2	11/22	1012.5
51004	17.4N	152.5W	0742	26.7	27.4	2.2	3.8	23/22	13.1	E	24.0	24/08	1012.3
52009	13.7N	144.7E	0632	27.9	28.4	1.9	4.0	21/01	12.5	NE	21.6	31/16	1008.1

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91222	18.1N	145.8E	0712	27.7					6.5	E	18.6	24/02	1008.9
91251	11.4N	162.4E	0723	28.1					8.9	NE	20.7	24/13	1008.2
91328	8.6N	149.7E	0736	27.6					8.0	SW	39.3	30/15	1007.1
91343	7.6N	155.2E	0741	28.0					4.3	SW	19.4	12/03	1005.7
91352	6.2N	160.7E	0738	28.0					5.1	SW	22.6	30/21	1008.4
91355	5.4N	163.0E	0739	27.4					6.0	E	23.9	10/14	1007.7
91377	6.1N	172.1E	0738	28.2									1007.5
ABAN6	44.3N	075.9W	0742	8.2	13.6				3.6	S	14.6	16/22	1017.6
ALSN6	40.5N	073.8W	0741	12.5	15.2	0.8	2.1	10/04	13.6	NW	38.2	17/08	1018.3
BURL1	28.9N	089.4W	0732	22.8					12.5	NE	34.1	03/03	1017.9
BUSL1	27.9N	090.9W	0741		25.5				12.7	NE	37.4	02/03	1017.8
BUZM3	41.4N	071.0W	0740	11.9					15.1	SW	30.2	10/08	1016.6
CARO3	43.3N	124.4W	0733	12.5					10.5	S	32.5	01/01	1015.4
CHLV2	36.9N	075.7W	0739	15.6	17.4	1.1	4.4	05/11	14.0	NE	38.2	05/03	1019.0
CLKN7	34.6N	076.5W	0741	18.0					10.9	NE	30.4	05/19	1018.8
CSBF1	29.7N	085.4W	0731	20.9					5.9	NE	18.4	04/10	1017.1
DBLN6	42.5N	079.4W	0741	10.1					11.7	SW	43.7	16/20	1017.4
DESW1	47.7N	124.5W	0737	11.5					12.2	SE	37.7	29/19	1015.7
DISW3	47.1N	090.7W	0733	6.8					12.0	W	30.4	08/20	1016.5
DPIA1	30.3N	088.1W	0730	20.9	22.8				10.4	NE	30.7	04/02	1018.1
DSLN7	35.2N	075.3W	0739	19.1	23.3	1.6	5.9	05/21	15.5	N	40.1	09/20	1018.4
FBIS1	32.7N	079.9W	0741	18.9					9.0	NE	22.6	18/03	1018.2
FFIA2	57.3N	133.6W	0743	6.5					14.7	SE	33.1	18/15	1010.0
FPSN7	33.5N	077.6W	0739	20.7	24.0				15.4	NE	45.0	05/20	1017.5
FWYF1	25.6N	080.1W	0741	26.1	27.7								1015.6
GDIL1	29.3N	090.0W	0734	22.3	23.4				10.1	NE	27.9	02/01	1017.3
GLLN6	43.9N	076.5W	0738	9.3					13.2	W	43.0	17/01	1017.4
IOSN3	43.0N	070.6W	0664	9.8					13.2	W	30.8	27/14	1016.4
MDRM1	44.0N	068.1W	0742	8.6					15.0	N	32.0	27/14	1015.3
MISM1	43.8N	068.9W	0740	8.9					14.9	SW	31.9	27/22	1015.6
MLRF1	25.0N	080.4W	0741	26.2	28.0				12.0	E	29.7	01/20	1014.9
NWPO3	44.6N	124.1W	0695	12.1					8.2	S	25.6	19/19	1017.2
PILM4	48.2N	088.4W	0739	5.9					12.2	NW	35.6	12/09	1015.8
PTAC1	39.0N	123.7W	0741	13.7					7.3	N	22.4	29/12	1015.4
PTAT2	27.8N	097.1W	0738	24.2	25.2				11.4	SE	32.5	17/01	1016.1
PTGC1	34.6N	120.7W	0737	15.9					11.7	N	25.5	04/03	1014.5
ROAM4	47.9N	089.3W	0685	6.2	7.9				13.7	NE	34.9	12/07	1015.9
SANF1	24.5N	081.9W	0743	26.2	28.0				11.6	NE	27.5	23/00	1015.0
SAUF1	29.9N	081.3W	0740	21.8	23.2				11.0	NE	31.9	03/21	1017.3
SBIO1	41.6N	082.8W	0740	11.1					11.8	SW	40.8	17/01	1017.6
SGNW3	43.8N	087.7W	0741	8.9	9.3				11.6	S	29.8	16/17	1016.4
SISW1	48.3N	122.9W	0740	11.1					10.2	SE	35.0	20/13	1016.3
SMKF1	24.6N	081.1W	0738	26.3	28.0				12.3	E	31.7	20/11	1015.2
SPGF1	26.7N	079.0W	0741	25.6	27.8				8.3	E	21.6	22/19	1016.5
SRST2	29.7N	094.1W	0734	21.8					9.4	SE	23.3	16/13	1017.0
STDM4	47.2N	087.2W	0741	6.5					15.0	NW	45.8	16/19	1015.2
SUPN6	44.5N	075.8W	0741	7.9	13.6				9.9	SW	34.6	17/05	1016.4
SVLS1	32.0N	080.7W	0387	20.3	20.8	0.6	1.5	23/16	12.5	NE	31.7	05/21	1017.3
THIN6	44.3N	076.0W	0741										
TTIW1	48.4N	124.7W	0739	11.1					12.5	NE	38.4	18/15	1015.9
VENF1	27.1N	082.5W	0739	22.6	25.5				8.7	NE	24.6	04/05	1016.6
WPOW1	47.7N	122.4W	0739	12.2					6.2	N	22.4	18/19	1015.7
NOVEMBER 1992													
32302	18.0S	085.1W	0710	18.0	18.7	1.7	3.2	03/19	11.2	SE	20.4	03/05	1015.2
41001	34.9N	073.0W	0612	19.5	22.9	2.0	5.3	13/14	14.1	NE	33.8	13/11	1020.9
41002	32.3N	075.2W	0711	21.5	24.4	2.0	3.9	21/15	15.0	S	25.6	08/12	1019.5
41004	32.5N	079.1W	0717	19.7	23.6	1.6	3.9	21/08	13.3	NE	27.0	20/13	1019.8
41006	29.3N	077.4W	0717	23.7	25.1	2.1	5.1	21/12					1017.7
41009	28.5N	080.2W	1429	23.5	25.5	1.9	4.6	20/14	15.9	S	27.2	09/18	1017.3
41010	28.9N	078.5W	1433	23.6	25.2	2.0	5.4	21/14	15.8	SE	29.0	21/11	1018.1
41016	24.6N	076.5W	0713	26.1	27.5	0.7	1.9	21/15	13.5	E	28.0	16/20	1015.4
42001	25.9N	089.7W	0713	22.4	24.7	1.5	2.9	05/13	14.8	NE	26.6	05/11	1017.2
42002	25.9N	093.6W	0719	22.1	25.0	1.6	3.9	05/00	15.0	E	31.5	12/19	1016.5
42003	25.9N	085.9W	0717	23.9	25.8	1.4	3.1	10/21	15.9	NE	27.0	11/07	1017.1
42007	30.1N	088.8W	0710	16.2	19.2				13.8	NE	27.4	13/03	1018.2
42019	27.9N	095.0W	0707	20.2	24.4	1.6	4.4	04/15	14.0	N	26.6	22/00	1016.6
42020	27.0N	096.5W	0707	20.9	23.9	1.6	4.4	04/16	14.4	SE	31.3	04/14	1016.4
44005	42.6N	068.6W	0680	6.4	8.6	1.5	4.3	24/13	12.8	N	30.5	13/12	1019.9
44007	43.5N	070.1W	0713	4.8	7.7	0.9	3.3	13/10	11.1	N	33.8	13/09	1021.1
44008	40.5N	069.4W	0713	9.2	11.2	1.6	4.3	14/00	13.9	N	31.3	13/10	1019.7
44011	41.1N	066.6W	0039	7.4	10.3	2.3	3.4	02/06	19.7	N	25.6	02/00	1019.8
44012	38.8N	074.6W	0214	10.6	14.4	1.2	2.2	03/01	14.4	N	28.2	03/07	1020.1
44013	42.4N	070.8W	0712	6.1	8.8	0.7	3.0	24/15	12.1	N	35.9	13/09	1020.8
44014	36.6N	074.8W	0706	13.3	14.4	1.5	3.2	13/08	11.7	N	25.6	06/04	1021.0
44025	40.3N	073.2W	0693	9.7	12.4	1.3	4.2	13/08	13.2	N	31.7	13/07	1021.0
45001	48.1N	087.8W	0182	1.1	5.0	1.5	4.9	02/16	16.7	E	34.6	02/14	1015.5
45002	45.3N	086.4W	0140	4.6	10.0	1.7	3.7	03/12	20.6	E	34.4	02/06	1010.5

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45003	45.3N	082.7W	0093	5.6	7.3	1.9	5.0	02/14	21.8	E	35.8	02/10	1011.8
45004	47.5N	086.5W	0169	1.7	5.6	1.5	4.3	02/17	17.6	E	33.8	02/14	1013.9
45005	41.7N	082.4W	0374	5.9	9.2	0.8	2.7	13/01	14.3	W	35.0	13/01	1018.0
45006	47.3N	089.9W	0192	0.9	5.4	1.5	4.8	02/18	12.9	N	27.2	02/11	1015.7
45007	42.8N	087.1W	0156	4.9	10.4	1.6	4.0	02/01	18.4	NW	33.8	02/01	1012.1
45008	44.3N	082.4W	0085	6.7	9.2	1.8	3.6	02/14	18.0	E	29.1	02/22	1013.1
46001	56.3N	148.2W	0714	5.7	6.8	3.5	9.8	29/06	17.1	W	34.0	28/14	1000.6
46002	42.5N	130.3W	0714	14.7	15.9	2.9	6.3	27/10	13.3	NW	28.0	27/06	1020.2
46003	51.9N	155.9W	0713	5.1	6.8	3.7	9.7	24/17	17.7	W	37.3	29/17	1002.3
46005	46.1N	131.0W	0711	12.7	14.1	3.5	6.9	22/04	16.8	NW	34.2	20/22	1017.4
46006	40.9N	137.5W	0706	15.4	16.2	3.1	6.5	26/18	13.4	S	31.7	26/16	1019.3
46012	37.4N	122.7W	0712	14.1	14.3	2.0	4.2	08/16	10.8	NW	25.8	20/04	1020.1
46013	38.2N	123.3W	0700	13.2	13.5	2.2	4.4	01/06	12.9	NW	29.5	08/00	1019.9
46014	39.2N	124.0W	0693	12.5	13.0	2.3	5.1	27/04	11.2	N	29.3	08/22	1020.8
46022	40.8N	124.5W	0711	12.0	12.7	2.4	5.3	22/21	9.4	N	28.6	22/02	1021.7
46023	34.3N	120.7W	0706	16.0	16.5	2.2	5.0	27/13	13.1	NW	25.1	18/01	1017.7
46025	33.8N	119.1W	0713	17.9	18.1	1.0	2.3	20/02	7.6	NW	26.2	20/01	1016.7
46026	37.8N	122.7W	0712	13.6	13.8	1.6	3.1	01/00	10.8	NW	26.4	07/06	1020.3
46027	41.8N	124.4W	0699	11.4	12.4	2.2	4.5	23/05					1021.4
46028	35.8N	121.9W	0712	15.1		2.3	4.7	27/07	12.7	NW	27.8	02/22	1019.2
46029	46.2N	124.2W	0712	10.6	12.0	2.7	6.9	22/18	12.6	E	32.3	21/11	1020.4
46030	40.4N	124.5W	0712	11.7	11.8	1.7	4.6	22/21	11.7	N	30.5	21/21	1021.1
46035	57.0N	177.7W	0712	1.5	4.5	4.3	10.8	13/02	19.7	NE	38.1	12/03	996.0
46041	47.4N	124.5W	0700	9.7	11.2	2.6	6.1	22/09	13.8	SE	32.8	21/06	1019.0
46042	36.8N	122.4W	0705	14.2		2.2	4.3	27/04	11.8	NW	25.3	20/05	1020.1
46045	33.8N	118.5W	0711	17.4	18.0	0.5	1.7	20/04	6.0	E	24.7	03/03	1016.1
46047	32.7N	119.6W	0702	17.3	18.0	2.3	4.3	01/02	13.3	NW	32.4	20/14	1017.4
46048	32.9N	117.9W	0712	18.1	18.7	1.0	2.5	01/08	7.4	NW	26.0	20/16	1016.1
46050	44.6N	124.5W	0711	11.3	12.3	2.7	7.0	22/20	11.9	S	39.8	21/18	1021.4
46051	34.5N	120.7W	0477	15.9	16.4	2.2	4.5	01/00	10.2	NW	22.5	02/21	1018.5
51001	23.4N	162.3W	0716	24.0	25.6	2.9	5.6	27/23	13.7	E	27.6	27/17	1015.5
51002	17.2N	157.8W	0535	26.5	27.1	2.5	4.2	28/23	14.4	E	25.3	10/16	1013.2
51003	19.3N	160.8W	0717	25.5	26.8	2.4	4.0	29/07	13.5	E	21.8	10/14	1012.7
51004	17.4N	152.5W	0714	26.1	26.8	2.7	4.0	27/12	14.2	E	27.0	27/23	1012.2
52009	13.7N	144.7E	0607	27.4	27.4	2.4	5.9	23/15	13.3	E	33.8	18/06	1008.6
91222	18.1N	145.8E	0696	27.3					9.2	E	21.4	23/04	1010.4
91251	11.4N	162.4E	0705	27.3					16.3	E	50.6	19/15	1009.3
91328	8.6N	149.7E	0712	27.6					7.8	NE	24.5	21/21	1008.2
91343	7.6N	155.2E	0706	27.8					5.4	NE	20.9	28/04	1008.5
91352	6.2N	160.7E	0707	27.6					7.1	NE	26.8	01/03	1008.7
91355	5.4N	163.0E	0705	27.2					7.7	E	23.0	21/04	1008.0
91377	6.1N	172.1E	0713	27.7									1008.0
ABAN6	44.3N	075.9W	0716		8.4				4.3	S	28.6	13/05	1020.0
ALSN6	40.5N	073.8W	0716	8.1	11.5	0.9	3.1	03/06	14.9	NW	42.0	13/07	1021.8
BURL1	28.9N	089.4W	0711	17.6					15.2	N	31.1	24/02	1018.2
BUSL1	27.9N	090.9W	0376		24.3				16.2	NE	31.2	12/18	1010.2
BUZM3	41.4N	071.0W	0717	7.4					14.5	N	44.7	13/10	1020.5
CARO3	43.3N	124.4W	0716	10.5					8.3	SE	41.4	21/22	1020.9
CHLV2	36.9N	075.7W	0719	12.6	14.3	1.1	2.5	21/03	13.7	N	32.1	06/04	1021.3
CLKN7	34.6N	076.5W	0716	15.5					11.8	NE	27.7	13/04	1021.0
CSBF1	29.7N	085.4W	0709	16.8					7.0	NE	19.8	12/14	1018.2
DBLN6	42.5N	079.4W	0707	5.4					12.4	SW	62.9	13/03	1016.3
DESW1	47.7N	124.5W	0709	9.2					14.4	SE	46.2	21/15	1019.0
DISW3	47.1N	090.7W	0711	0.9					14.2	NE	43.5	02/14	1016.8
DPIA1	30.3N	088.1W	0712	15.1	17.4				12.9	NE	29.3	13/03	1019.0
DSLN7	35.2N	075.3W	0715	17.3	21.8	1.7	3.8	13/08	17.5	N	42.0	13/06	1020.8
FBIS1	32.7N	079.9W	0719	15.7					10.0	NE	25.8	20/11	1019.8
FFIA2	57.3N	133.6W	0709	5.6					13.0	SE	37.8	12/18	1010.0
FPSN7	33.5N	077.6W	0718	19.0	22.5				17.8	N	36.8	13/07	1015.0
FWYF1	25.6N	080.1W	0715	25.1	26.4								1016.3
GDIL1	29.3N	090.0W	0709	16.2	18.6				11.8	NE	28.1	13/03	1017.9
GLLN6	43.9N	076.5W	0715	4.7					15.8	NE	49.0	13/06	1019.5
IOSN3	43.0N	070.6W	0692	5.1					13.1	W	34.1	13/09	1020.7
LONF1	24.9N	080.9W	0526	24.1	24.9				13.7	SE	24.1	15/13	1016.1
MDRM1	44.0N	068.1W	0717	4.8					15.1	N	44.0	13/11	1020.0
MISM1	43.8N	068.9W	0717	4.9					14.7	N	48.6	13/11	1020.3
MLRF1	25.0N	080.4W	0718	25.3	26.7				15.9	SE	29.5	21/00	1015.5
NWPO3	44.6N	124.1W	0664	9.7					8.9	E	44.0	21/19	1021.1
PILM4	48.2N	088.4W	0717	-0.5					14.2	N	37.7	02/13	1016.7
PTAC1	39.0N	123.7W	0715	11.7					9.0	N	25.1	22/17	1021.3
PTAT2	27.8N	097.1W	0711	17.9	19.6				12.3	N	31.7	04/07	1016.6
PTGC1	34.6N	120.7W	0714	15.6					13.1	N	32.1	23/12	1017.9
ROAM4	47.9N	089.3W	0716	-0.4	6.3				15.6	N	39.6	10/20	1017.0
SANF1	24.5N	081.9W	0715	25.0	26.6				14.4	NE	27.3	16/09	1015.4
SAUF1	29.9N	081.3W	0709	19.0					10.5	NW	26.6	16/21	1018.8
SBIO1	41.6N	082.8W	0717	5.4					13.9	SW	40.4	13/01	1017.4

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SGNW3	43.8N	087.7W	0715	2.5	5.8				13.0	W	37.3	23/01	1016.0
SISW1	48.3N	122.9W	0712	8.3					11.9	SE	40.0	19/04	1019.8
SMKF1	24.6N	081.1W	0711	25.2	26.7				16.1	SE	28.2	11/01	1015.6
SPGF1	26.7N	079.0W	0714	24.4	26.5				9.9	SE	25.4	10/03	1017.8
SRST2	29.7N	094.1W	0714	13.7					10.1	E	28.5	01/04	1017.7
STDM4	47.2N	087.2W	0715	0.7					17.3	NW	44.4	13/07	1015.6
SUPN6	44.5N	075.8W	0717	3.4	8.3				9.8	SW	47.8	13/06	1018.7
SVLS1	32.0N	080.7W	0717	16.9	19.0	1.1	2.7	20/18	15.3	NE	33.4	20/13	1019.3
TTIW1	48.4N	124.7W	0715	8.7					15.9	E	40.7	24/14	1019.0
VENF1	27.1N	082.5W	0572	21.6	23.2				9.9	NE	20.7	13/21	1017.4
WPOW1	47.7N	122.4W	0710	8.7					8.1	S	30.5	30/12	1019.5
DECEMBER 1992													
32302	18.0S	085.1W	0737	19.8	20.0	2.1	4.9	24/05	10.0	SE	18.5	27/11	1014.5
41002	32.3N	075.2W	0740	18.8	23.2	2.5	6.6	11/10	16.0	SW	34.6	10/21	1019.2
41004	32.5N	079.1W	0739	14.8	20.6								1021.3
41006	29.3N	077.4W	0742	21.4	23.9	2.0	4.9	11/17	12.5	W	30.3	11/04	1019.3
41009	28.5N	080.2W	1484	20.9	24.0	1.5	3.7	15/11	12.2	N	27.2	12/04	1019.9
41010	28.9N	078.5W	1481	21.5	24.5	1.9	5.3	15/06	12.7	NE	29.0	11/02	1020.1
41016	24.6N	076.5W	0742	23.7	26.1	0.6	1.4	26/02	12.8	NE	22.9	29/21	1018.3
42001	25.9N	089.7W	0740	22.1	22.7	1.1	2.3	16/01	11.4	E	22.2	11/08	1020.2
42002	25.9N	093.6W	0743	23.0	23.5	1.2	3.2	15/21	11.4	SE	24.1	17/13	1018.6
42003	25.9N	085.9W	0744	22.5	24.3	1.1	2.7	11/13	12.8	E	25.3	15/20	1020.6
42007	30.1N	088.8W	0742	14.5	16.2				12.3	NE	26.8	24/11	1020.7
42019	27.9N	095.0W	0740	20.6	22.7	1.5	4.3	14/02	13.9	SE	32.8	13/18	1018.1
42020	27.0N	096.5W	0739	20.6	22.7	1.4	4.5	13/20	12.7	SE	39.6	13/18	1017.8
44005	42.6N	068.6W	0742	3.4	6.7	2.7	8.8	12/17	18.8	NW	40.2	12/09	1017.0
44007	43.5N	070.1W	0742	0.9	6.5	1.4	6.8	12/23	15.7	SW	38.3	26/00	1019.2
44008	40.5N	069.4W	0258	5.0	9.1	1.9	4.3	04/02	21.0	NW	40.2	11/16	1012.0
44013	42.4N	070.8W	0742	2.0	6.0	1.2	7.3	12/17	16.8	W	44.7	12/09	1018.7
44014	36.6N	074.8W	0742	9.5	11.8	2.0	7.8	11/00	15.2	N	39.6	10/23	1020.0
44025	40.3N	073.2W	0727	5.8	8.9	1.7	9.3	11/15	16.2	W	43.7	11/13	1019.4
46001	56.3N	148.2W	0738	3.2	5.3	3.6	11.0	13/17	16.3	W	34.0	14/14	1008.4
46002	42.5N	130.3W	0740	10.8	13.9	4.0	9.5	02/20	16.6	NW	37.7	02/16	1016.5
46003	51.9N	155.9W	0740	3.9	4.8	4.0	11.3	05/14	18.1	W	46.2	13/06	1011.5
46005	46.1N	131.0W	0739	8.9	11.7	4.1	8.8	28/16	17.2	NW	36.7	28/15	1014.1
46006	40.9N	137.5W	0735	11.8	14.4	3.9	9.8	08/22	16.5	NW	36.1	28/04	1023.0
46012	37.4N	122.7W	0738	12.4	13.7	2.5	5.1	12/05	12.7	N	29.7	28/12	1017.2
46013	38.2N	123.3W	0741	11.1	12.7	2.9	6.2	09/21	13.2	NW	29.1	15/04	1016.4
46014	39.2N	124.0W	0738	10.8	12.3	3.2	6.6	15/23	12.4	N	30.1	28/04	1016.7
46022	40.8N	124.5W	0729	10.1	11.6	3.3	7.6	18/03	13.7	N	39.8	10/10	1016.3
46023	34.3N	120.7W	0742	13.6	14.6	2.6	5.8	08/11	10.5	NW	23.9	06/16	1017.6
46025	33.8N	119.1W	0736	14.2	15.5	1.2	3.1	08/11	9.0	NW	28.2	12/07	1017.4
46026	37.8N	122.7W	0735	10.9	12.5	2.0	4.0	03/05	14.0	NE	39.4	06/22	1017.3
46027	41.8N	124.4W	0736	9.4	11.3	3.1	6.7	09/16					1015.7
46028	35.8N	121.9W	0737	13.2		2.8	6.1	10/02	10.5	NW	27.8	13/08	1017.9
46029	46.2N	124.2W	0737	7.4	9.7	3.1	8.0	17/14	14.3	E	33.7	10/23	1014.4
46030	40.4N	124.5W	0741	10.1	11.4	2.6	5.4	17/23	14.4	N	34.4	10/12	1015.9
46035	57.0N	177.7W	0743	-0.6	2.9	3.8	8.7	05/00	18.0	N	37.3	01/07	1003.5
46041	47.4N	124.5W	0726	6.5	8.9	2.9	7.1	09/21	14.2	SE	32.6	08/10	1013.3
46042	36.8N	122.4W	0735	12.3		2.8	5.5	03/07	11.9	S	29.0	06/22	1017.8
46045	33.8N	118.5W	0735	13.6	15.3	0.9	2.6	08/15	7.6	E	25.1	13/08	1016.9
46047	32.7N	119.6W	0730	14.6	15.8	2.5	5.6	08/17	11.6	NW	33.2	12/20	1018.0
46048	32.9N	117.9W	0735	14.8	16.2	1.2	3.1	12/13	8.8	NW	30.3	12/11	1017.1
46050	44.6N	124.5W	0734	8.7	10.9	3.4	8.0	17/18	14.0	S	35.4	08/08	1015.2
46051	34.5N	120.7W	0731	13.4	14.9	2.5	4.9	08/06	9.9	N	25.1	12/05	1018.0
51001	23.4N	162.3W	0738	23.7	24.8	2.8	5.5	14/08	13.6	E	23.7	18/11	1014.6
51002	17.2N	157.8W	0246	25.7	26.2	2.8	4.9	06/14	16.2	E	26.3	06/11	1013.5
51003	19.3N	160.8W	0743	25.0	25.8	2.4	4.1	07/01	12.2	E	24.9	17/07	1012.5
51004	17.4N	152.5W	0739	24.5	25.7	2.8	4.3	12/21	16.0	E	24.0	06/03	1013.1
52009	13.7N	144.7E	0561		25.9	2.4	4.0	08/06	16.2	NE	26.0	20/05	1012.0
91222	18.1N	145.8E	0723	25.4					7.3	NE	17.9	07/05	1014.9
91251	11.4N	162.4E	0735	26.7					17.9	NE	30.9	28/08	1010.2
91328	8.6N	149.7E	0742	27.4					11.6	NE	20.4	19/10	1009.3
91343	7.6N	155.2E	0739	27.3					13.3	NE	23.2	14/20	1009.2
91352	6.2N	160.7E	0737	27.7					11.0	NE	20.2	20/22	1008.6
91355	5.4N	163.0E	0741	27.6					9.6	NE	22.5	18/21	1007.5
91377	6.1N	172.1E	0741	27.7									1007.1
ABAN6	44.3N	075.9W	0732		4.1				5.2	S	23.5	11/21	1019.8
ALSN6	40.5N	073.8W	0742	4.0	9.5	1.3	7.3	11/17	17.8	NW	69.5	11/16	1020.3
CARO3	43.3N	124.4W	0737	7.7					11.0	SE	41.7	10/10	1014.8
CHLV2	36.9N	075.7W	0743	7.5	9.1	1.3	4.2	11/00	16.6	N	41.1	10/22	1020.7
CLKN7	34.6N	076.5W	0740	10.2					13.4	N	38.3	10/18	1020.9
CSBF1	29.7N	085.4W	0741	14.4					6.1	NE	21.2	10/21	1020.9
DBLN6	42.5N	079.4W	0742	1.3					14.7	SW	47.5	26/00	1016.2
DESW1	47.7N	124.5W	0737	5.6					14.9	SE	38.9	08/06	1013.3

NDBC Station Data Summary

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
DISW3	47.1N	090.7W	0738	-4.4					13.1	W	43.1	25/09	1016.4
DPIA1	30.3N	088.1W	0599	13.9	14.2				11.6	N	28.0	05/14	1020.5
DRYF1	24.6N	082.9W	0539	22.7	24.1				13.0	NE	22.2	11/14	1019.1
DSLN7	35.2N	075.3W	0742	12.1	16.7	2.1	6.2	10/23	19.9	N	54.9	10/21	1020.2
FBIS1	32.7N	079.9W	0743	10.3					8.9	NE	26.9	10/08	1021.5
FFIA2	57.3N	133.6W	0737	0.6					18.0	N	41.8	29/14	1010.2
FPSN7	33.5N	077.6W	0741	13.8	19.0				19.0	N	40.0	12/04	1021.0
FWYF1	25.6N	080.1W	0742	22.8	24.7								1019.6
GDIL1	29.3N	090.0W	0737	15.7	16.4				10.0	NE	24.0	24/14	1020.3
GLLN6	43.9N	076.5W	0735	0.2					17.3	S	46.4	26/06	1019.0
IOSN3	43.0N	070.6W	0741	0.9					17.5	W	48.1	12/10	1018.6
LONF1	24.9N	080.9W	0601	21.8	22.0				10.3	NE	23.5	11/22	1019.1
MDRM1	44.0N	068.1W	0739	1.3					21.4	NW	47.0	25/01	1017.2
MISM1	43.8N	068.9W	0742	1.2					20.0	W	46.7	24/20	1018.1
MLRF1	25.0N	080.4W	0742	22.9	25.2				13.0	E	28.5	30/03	1018.8
NWPO3	44.6N	124.1W	0700	6.5					10.0	E	38.7	20/04	1014.8
PILM4	48.2N	088.4W	0741	-5.5					15.6	NW	42.6	25/13	1015.8
PTAC1	39.0N	123.7W	0739	9.5					10.6	N	31.1	28/08	1017.1
PTAT2	27.8N	097.1W	0737	15.5	15.7				10.7	N	31.9	14/06	1018.1
PTGC1	34.6N	120.7W	0739	12.7					10.7	N	33.0	06/19	1017.6
ROAM4	47.9N	089.3W	0742	-5.5					17.3	NW	38.9	25/13	1016.3
SANF1	24.5N	081.9W	0742	22.6	24.9				13.4	NE	22.5	11/16	1018.9
SAUF1	29.9N	081.3W	0739	14.7					10.3	N	27.2	28/00	1021.3
SBIO1	41.6N	082.8W	0742	0.9					14.3	W	38.2	24/03	1019.1
SGNW3	43.8N	087.7W	0740	-2.1	2.0				12.6	W	40.2	27/07	1017.7
SISW1	48.3N	122.9W	0732	5.0					15.1	SE	44.8	08/07	1014.5
SMKF1	24.6N	081.1W	0741	22.7	24.7				14.0	NE	24.3	11/16	1019.0
SPGF1	26.7N	079.0W	0741	21.9	25.0				8.9	E	25.3	12/04	1020.7
SRST2	29.7N	094.1W	0423	13.9					8.3	E	19.0	24/12	1021.1
STDM4	47.2N	087.2W	0741	-3.1					20.2	NW	50.8	25/22	1014.8
SUPN6	44.5N	075.8W	0742	-2.1	3.9				10.6	NE	36.3	26/02	1018.2
SVLS1	32.0N	080.7W	0743	11.4	13.7	0.9	2.4	27/12	14.8	NE	32.6	12/02	1021.3
TTIW1	48.4N	124.7W	0740	5.3					18.5	E	42.0	28/03	1013.5
VENF1	27.1N	082.5W	0534	18.6	19.1				7.9	NE	27.8	11/09	1020.6
WPOW1	47.7N	122.4W	0736	5.4					10.2	S	30.4	09/00	1013.9

Port Meteorological Services

DMA Representatives

Tom Hunter
DMA/HTC Rep.
ATTN: MCC 3 (Mail Stop D44)
4600 Sangamore Rd.
Bethesda, MD 20816
301-227-3370

Walt Holgren
DMA/HTC Gulf Coast Rep.
One Canal Place
365 Canal St., suite 2300
New Orleans, LA. 70130
504-589-2642

Gary Rogan
DMA/HTC West Coast Rep.
2518 B Custom House
300 South Ferry St.
Terminal Island, CA 90731
310-514-6177

Northwest England
Captain Albert Britain, PMO
Room 218,
Royal Liver Building
Liverpool L3 1HU
Tel: 051-236 6565 FAX: 051-227 4762

Scotland and Northern Ireland
Captain Stuart M. Norwell, PMO
Navy Buildings, Eldon St.
Greenock, Strathclyde PA16 7SL
Tel: (0475) 24700 FAX: (0475) 892879

Bristol Channel
Captain Archie F. Ashton, PMO
Cardiff Weather Centre
Southgate House, Wood Street
Cardiff CF1 1EW
Tel: Cardiff(0222) 221423
FAX: (0222) 390435

Southwest England
Captain Douglas R. McWhan, PMO
8 Viceroy House
Mountbatten Centre
Millbrook Rd. East
Southampton SO1 OHY
Tel: Southampton (0703) 220632
FAX: (0703) 337341

Southeast England
Captain Clive R. Downes, PMO
Daneholes House, Hogg Lane
Grays, Essex RM17 5QH
Tel: Grays Thurrock (0375) 378369
FAX: (0375) 379320

Northeast England
Captain John Steel, PMO
Room D418 Corporation House
73-75 Albert Road
Middlesbrough, Cleveland TS1 2RZ
Tel: Middlesbrough (0642) 231622
FAX: (0642) 242676

East England
Captain Edward J. O'Sullivan, PMO
Customs Bldg, Alber Dock
Hull HU1 2DP
Tel: Hull (0482) 20158
FAX: (0482) 28957

Netherlands
Mr. H.P. de Jager, PMO
Aero. Met Division of KNMI
Rotterdam Airport
Tel: (010)- 437 0766

New Zealand
Ms. Julie Fletcher
Marine Meteorological Officer
Met. Service of New Zealand Ltd.
Tahi Rd., Box 1515
Paraparaumu Beach 6153
New Zealand
Tel: 64 4 2973237
FAX: 64 4 2973568

Japan
Mr. S. Sasanara, PMO
Yokohama Local Met. Observatory
Yamate-cho, Naka-ku
Yokohama, Japan
Tel: (045)-621-1991

Mr. M. Miyauchi
Japan Meteorological Agency
Otemachi, Chiyoda-ku
Tokyo, 100 Japan
Tel: (03)-212-8341

Hong Kong
Mr. Ip Sui Fui, PMO
134A Nathan Road
Kowloon, Hong Kong
Tel: 732-9263/9200

Germany
Mr. Henning Hesse, PMO
Wetterwarte, An der neuen Schleuse
Bremerhaven Tel: (0471) 72220

Mr. Jurgen Guehne, PMO
Seewetteramt
Bernhard Nocht-Strasse 76
Hamburg Tel: (040) 3190 8826

Kenya
Mr. Ali J. Mafimbo, PMO
PO Box 98512
Mombassa
Tel: (11) 25685 or 433440

Saudi Arabia
Mr. M. Murwani, PMO
National Meteorological Environment
Centre, Jeddah
Tel: (020) 683-4444 ext. 325

Singapore
Mr. Edmund Lee, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Tel: 5457198

France
Mr. Yann Prigent, PMO
Station Météorologique
Noveau Semaphore
Quai des Abeilles, Le Harve
Tel: 35.42.21.06

Mr. A. Rouzier
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: 91.91.46.51, poste 336

South Africa
Mr. C. Sydney Marais, PMO
Roggebaai, Capetown, 8012
Tel: (021) 217543

Mr. Peter Rae, PMO
Meteorological Office
Louis Botha Airport, Durban 4029

Australia
Captain Alan H. Pickles, PMA
Stirling Marine
17 Mews Road
Fremantle, WA 6160
Tel: (09) 335 8444 Fax: (09) 335 3286.
Telex: 92821

Mr. M. Hills, PMA
Pier 14, Victoria Dock
Melbourne, Vic. Tel: (03) 629 1810

Mr. E.E. Rowlands, PMA
NSW Regional Office
Bureau of Meteorology
580 George St.
Sydney, NSW 2000
Tel: (02) 269 8555
FAX: (02) 269-8589

Greece
Mr. George E. Kassimidis, PMO
Port Office, Piraeus
Tel: (00301) 4135502
(00301) 9628942

SEAS Field Representatives
Mr. Robert Decker
Seas Logistics/ PMC
7600 Sand Point Way N.E.
Seattle, WA 98115
206-526-4280
FAX: 206-526-6365
TELEX 7408535/BOBD UC

Mr. Steven Cook
SEAS Operations Manager
8604 La Jolla Shores Dr.
La Jolla, CA 92037
619-546-7103
FAX: 619-546-7003
TELEX 7408528/ COOK UC

Mr. Jim Farrington
SEAS Logistics/ A.M.C.
439 West York St.
Norfolk, VA 23510
804-441-3062
FAX: 804-441-6495
TELEX7408830/ MAPA UC

Mr. Robert Benway
National Marine Fisheries Service
28 Tarzwell Dr.
Narragansett, RI 02882
401-782-3295
FAX: 401-782-3201

Mr. Warren Krug
Atlantic Oceanographic & Met. Lab.
4301 Rickenbacker Causeway
Miami, FL 33149
305-361-4433
FAX: 305-361-4582
TELEX 7408765 LORI UC

Steve Ranne, Petty Officer USN
FLENUMOCEANCEN, Code 64
Monterey, CA 93943
408-647-4428
FAX: 408-647-4489

Atlantic Ports

Mr. Charles E. Henson, PMO
National Weather Service, NOAA
1600 Port Boulevard
Miami, FL 33132
305-358-6027

Mr. Lawrence Cain, PMO
National Weather Service, NOAA
Jacksonville International Airport
Box 18367
Jacksonville, FL 32229
904-741-4370

Mr. Earle Ray Brown, Jr., PMO
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
804-441-6326 FAX: 804-441-6495

Mr. James Saunders, PMO
National Weather Service, NOAA
Weather Service Office
BWI Airport
Baltimore, MD 21240
410-850-0529 FAX: 410-859-3960

Mr. Martin Bonk, PMO
National Weather Service, NOAA
Building 51
Newark International Airport
Newark, NJ 07114
201-645-6188

Dan Pero, PMO
National Weather Service, NOAA
30 Rockefeller Plaza
New York, NY 10112
212-399-5569

Mr. Randy Sheppard, PMO
Atmospheric Environment Service
1496 Bedford Highway
Bedford, (Halifax) Nova Scotia B4A
1ES 902-426-6703

Mr. Denis Blanchard
Atmospheric Environment Service
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6
514-283-6325

Mr. D. Miller, PMO
Atmospheric Environment Service
Bldg. 303, Pleasantville
P.O. Box 21130, Postal Station "B"
St. John's, Newfoundland A1A 5B2
709-772-4798

Gulf of Mexico Ports

Mr. John Warrelmann, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field, Box 20026
New Orleans, LA 70141
504-589-4839

Mr. James Nelson, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road
Dickinson, TX 77539
713-534-2640

Pacific Ports

PMO, W/PRx2
Pacific Region, NWS, NOAA
Prince Kuhio Fed. Bldg., Rm 411
P.O. Box 50027
Honolulu, HI 96850
808-541-1670

Mr. Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd.
Room 4480
Long Beach, CA 90802-4213
310-980-4090 FAX: 310-980-4089
TELEX: 7402731/BOBW UC

Mr. Robert Novak, PMO
National Weather Service, NOAA
Coast Guard Island P.O. Box 5027
Alameda, CA 94501
510-273-6257
TELEX: 7402795/WPMO UC

Mr. David Bakeman, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
BIN C15700
Seattle, WA 98115
206-526-6100

Mr. Bob McArter, PMO
Atmospheric Environment Service
700-1200 W. 73rd Av.
Vancouver, British Columbia
V69 6H9
604-664-9136

Mr. Dan Keeton, MIC
National Weather Service, NOAA
Box 37, USCG Base
Kodiak, AK 99619
907-487-2102/4338

Mr. Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427
Valdez, AK 99686
907-835-4505

Marine Program Mgr. W/AR121x3
Alaska Region
National Weather Service
222 West 7th Avenue #23
Anchorage, AK 99513-7575
907-271-5121

Great Lakes Ports

Mr. Bob Collins, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60441
815-834-0600 FAX: 815-834-0645

Mr. George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
216-265-2374

Port Meteorological Officer
Atmospheric Environment Service
25 St. Clair Av. East
Toronto, Ontario
M4T 1M2
416-973-5809

Mr. Ronald Fordyce
National Water Research Institute
Port Meteorological Office
P.O. Box 5050
867 Lakeshore Rd.
Burlington, Ontario
L7R 4R6
416-336-6420 (FAX 416-336-4797)

U.S. Headquarters

Mr. Vincent Zegowitz
Marine Obs. Program Leader
National Weather Service, NOAA
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Mr. Martin Baron
VOS Program Manager
National Weather Service, NOAA
Room 17345
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Richard DeAngelis, Editor
Mariners Weather Log, NODC
1825 Connecticut Av., NW
Washington, DC 20235
202-606-4561
Fax: 202-606-4586

United Kingdom Headquarters

Captain Gordon V. Mackie,
Marine Superintendent, BD (OM)
Meteorological Office Met O (OM)
Scott Building, Eastern Road
Bracknell, Berks RG12 2PW
Tel:(0344) 855654 Fax: (0344)
855921
Telex: 849801 WEABKA G

Australia Headquarters

Mr. A.D. Baxter, Headquarters
Bureau of Meteorology
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150 Lonsdale Street
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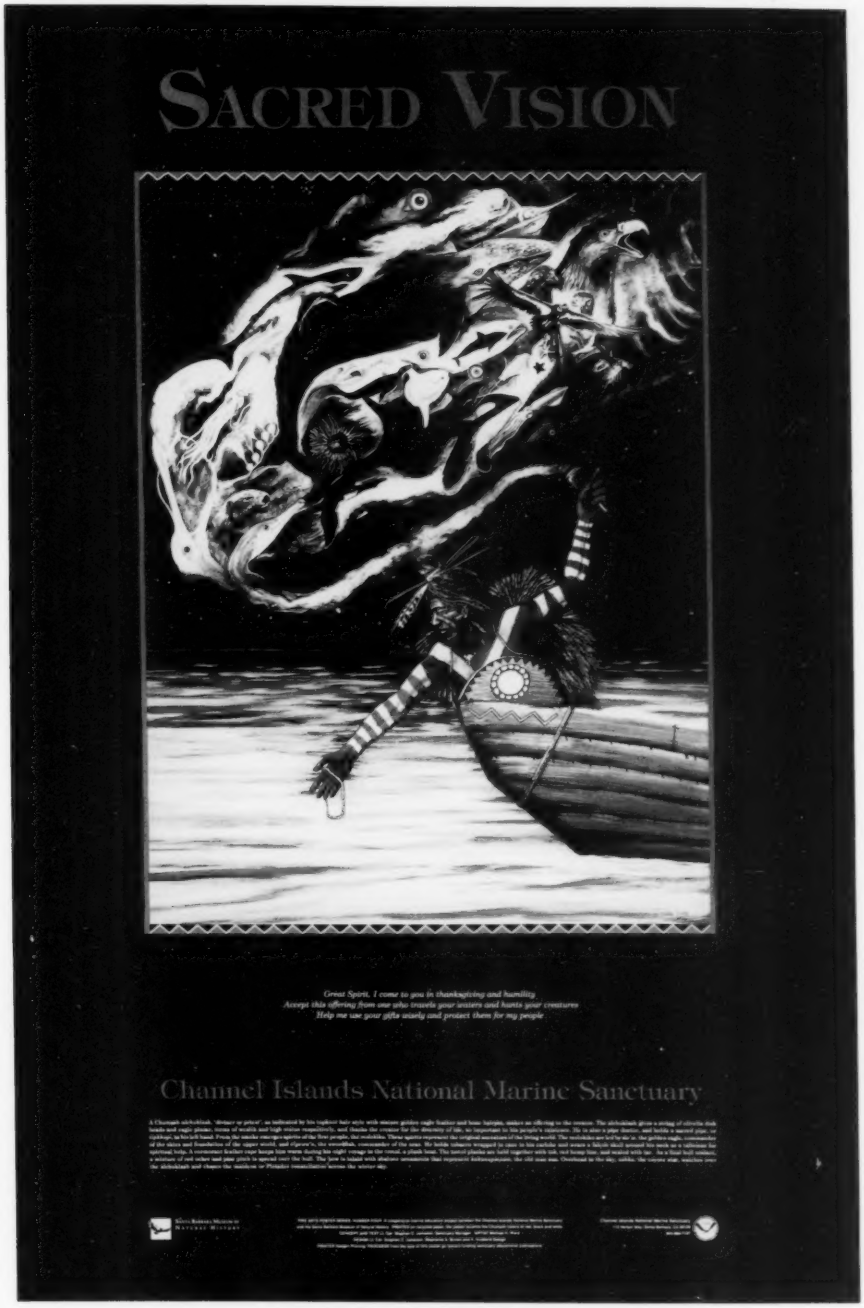

This is the poster that provided the artwork for the current issue of the *Mariners Weather Log*. It is stunning in full color and was produced by the Sea Center which is a joint effort of the Channel Islands National Marine Sanctuary and the Santa Barbara Museum of Natural History. The proceeds from the poster support the educational programs of the Sanctuary. The cost of the poster, which measures 24 inches x 36 inches, is $12 plus $1.50 shipping and handling (California residents must add sales tax). Checks can be made out to **Sea Center**. It is available from

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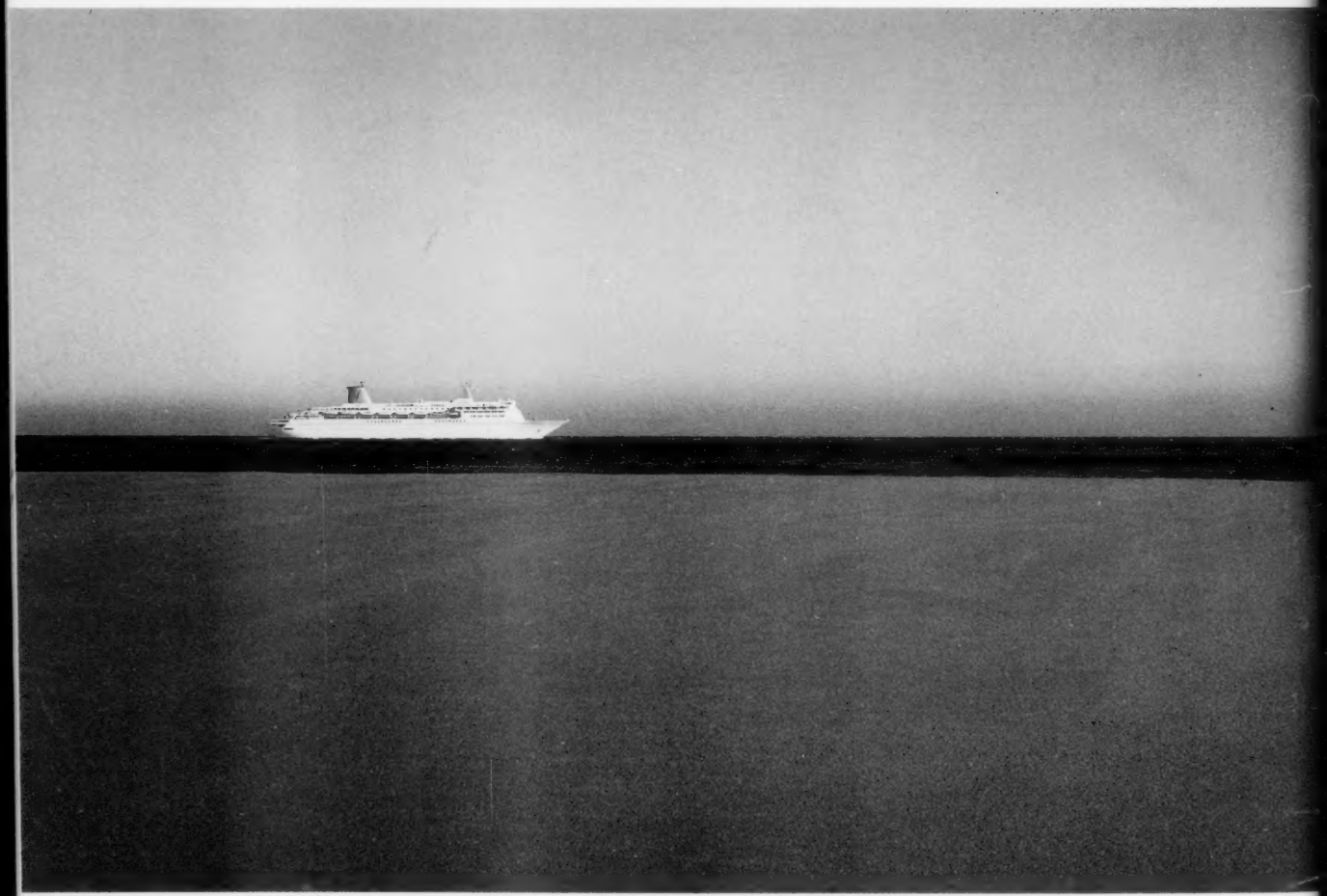

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